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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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02 AERODYNAMICS

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VOLUME 16 NUMBER 9 / MAY 8, 1978

TABLE OF CONTENTS

AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

01 AERONAUTICS (GENERAL) 1103

02 AERODYNAMICS 1103

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

03 AIR TRANSPORTATION AND SAFETY 1107

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION 1108

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command and Tracking* and *32 Communications*.

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE 1110

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

06 AIRCRAFT INSTRUMENTATION 1113

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

07 AIRCRAFT PROPULSION AND POWER 1114

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

08 AIRCRAFT STABILITY AND CONTROL 1116

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

09 RESEARCH AND SUPPORT FACILITIES (AIR) 1117

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

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Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

For related information see also *Aeronautics*.

12 ASTRONAUTICS (GENERAL) 1118

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

13 ASTRODYNAMICS 1118

Includes powered and free-flight trajectories; and orbit and launching dynamics.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE) 1119

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research and Support Facilities (Air)*.

15 LAUNCH VEHICLES AND SPACE VEHICLES 1119

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

16 SPACE TRANSPORTATION 1120

Includes passenger and cargo space transportation, e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING 1121

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE 1122

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

19 SPACECRAFT INSTRUMENTATION 1122
For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

20 SPACECRAFT PROPULSION AND POWER 1123
Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.
For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

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23 CHEMISTRY AND MATERIALS (GENERAL) 1124
Includes biochemistry and organic chemistry.

24 COMPOSITE MATERIALS 1124
Includes laminates.

25 INORGANIC AND PHYSICAL CHEMISTRY 1126
Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.
For related information see also *77 Thermodynamics and Statistical Physics*.

26 METALLIC MATERIALS 1129
Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

27 NONMETALLIC MATERIALS 1134
Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

28 PROPELLANTS AND FUELS 1137
Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.
For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion*.

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Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.
For related information see also *Physics*.

31 ENGINEERING (GENERAL) 1138
Includes vacuum technology; control engineering; display engineering; and cryogenics.

32 COMMUNICATIONS 1141
Includes land and global communications; communications theory; and optical communications.
For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

33 ELECTRONICS AND ELECTRICAL ENGINEERING 1147
Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.
For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

34 FLUID MECHANICS AND HEAT TRANSFER 1153
Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.
For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

35 INSTRUMENTATION AND PHOTOGRAPHY 1159
Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.
For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation* and *19 Spacecraft Instrumentation*.

36 LASERS AND MASERS 1162
Includes parametric amplifiers.

37 MECHANICAL ENGINEERING 1164
Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

38 QUALITY ASSURANCE AND RELIABILITY 1167
Includes product sampling procedures and techniques; and quality control.

39 STRUCTURAL MECHANICS 1167
Includes structural element design and weight analysis; fatigue; and thermal stress.
For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

GEOSCIENCES

Includes geosciences (general); earth resources; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.
For related information see also *Space Sciences*.

42 GEOSCIENCES (GENERAL) N.A.

43 EARTH RESOURCES 1172
Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography*.

44 ENERGY PRODUCTION AND CONVERSION 1176
Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.
For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation*.

45 ENVIRONMENT POLLUTION 1183
Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

46 GEOPHYSICS 1188
Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.
For space radiation see *93 Space Radiation*.

47 METEOROLOGY AND CLIMATOLOGY 1190
Includes weather forecasting and modification.

48 OCEANOGRAPHY 1195
Includes biological, dynamic and physical oceanography; and marine resources.

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51 LIFE SCIENCES (GENERAL) 1197
Includes genetics.

52 AEROSPACE MEDICINE 1197
Includes physiological factors; biological effects of radiation; and weightlessness.

53 BEHAVIORAL SCIENCES 1208
Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT 1208
Includes human engineering; biotechnology; and space suits and protective clothing.

55 PLANETARY BIOLOGY 1210
Includes exobiology; and extraterrestrial life.

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59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL) N.A.

60 COMPUTER OPERATIONS AND HARDWARE 1210
Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering*.

61 COMPUTER PROGRAMMING AND SOFTWARE 1212
Includes computer programs, routines, and algorithms.

62 COMPUTER SYSTEMS 1215
Includes computer networks.

63 CYBERNETICS 1216
Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support*.

64 NUMERICAL ANALYSIS 1217
Includes iteration, difference equations, and numerical approximation.

65 STATISTICS AND PROBABILITY 1221
Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

66 SYSTEMS ANALYSIS 1222
Includes mathematical modeling; network analysis; and operations research.

67 THEORETICAL MATHEMATICS 1222
Includes topology and number theory.

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For related information see also *Engineering*.

70 PHYSICS (GENERAL) N.A.
For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar Physics*.

71 ACOUSTICS 1223
Includes sound generation, transmission, and attenuation.
For noise pollution see *45 Environment Pollution*.

72 ATOMIC AND MOLECULAR PHYSICS 1224
Includes atomic structure and molecular spectra.

73 NUCLEAR AND HIGH-ENERGY PHYSICS 1226
Includes elementary and nuclear particles; and reactor theory.
For space radiation see *93 Space Radiation*.

74 OPTICS 1227
Includes light phenomena.

75 PLASMA PHYSICS 1230
Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

76 SOLID-STATE PHYSICS 1232
Includes superconductivity.
For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

77 THERMODYNAMICS AND STATISTICAL PHYSICS 1235
Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

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Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) N.A.
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 1235
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 1237
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software*.

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Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 1238
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 1241
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 1242
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 1243
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 1243
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 1244
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

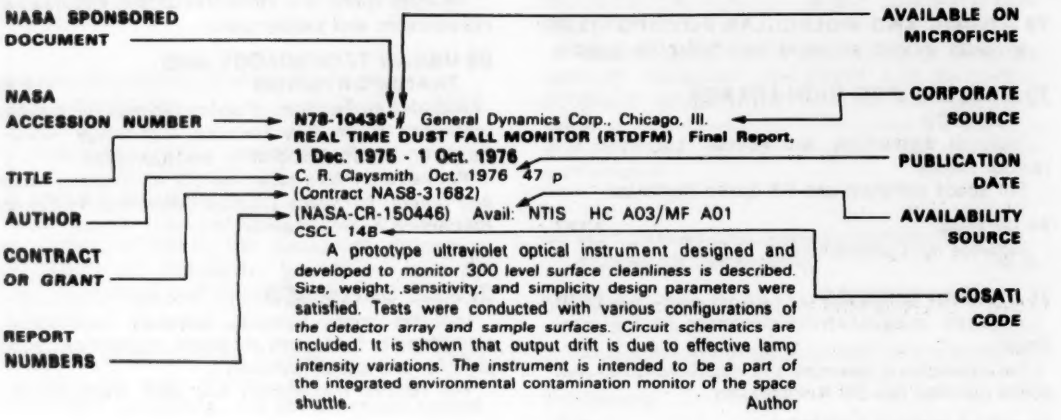
GENERAL

99 GENERAL 1244

Note: N.A. means that no abstracts were assigned to this category for this issue.

SUBJECT INDEX I-1
PERSONAL AUTHOR INDEX I-49
CORPORATE SOURCE INDEX I-57
CONTRACT NUMBER INDEX I-71
REPORT/ACCESSION NUMBER INDEX I-75

TYPICAL CITATION AND ABSTRACT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REAL TIME DUST FALL MONITOR (RTDFM) Final Report, 1 Dec. 1975 - 1 Oct. 1976
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C. R. Claysmith Oct. 1976 47 p
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COSATI CODE
A prototype ultraviolet optical instrument designed and developed to monitor 300 level surface cleanliness is described. Size, weight, sensitivity, and simplicity design parameters were satisfied. Tests were conducted with various configurations of the detector array and sample surfaces. Circuit schematics are included. It is shown that output drift is due to effective lamp intensity variations. The instrument is intended to be a part of the integrated environmental contamination monitor of the space shuttle.
Author
REPORT NUMBERS

ON-GOING RESEARCH PROJECTS

This is a listing of research projects— not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, AFAPL SENIOR INVESTIGATOR PROGRAM

R. WEBB, Auburn University, Graduate School, *Auburn, Alabama* 36830 (DF459300; F33615-76-C-2050)

The objective of this effort is to obtain expert assistance in solving complex and persistent problems in air-breathing propulsion, laser aerodynamics, power generation and distribution, related systems and materials.

This effort is a dual award with both Purdue Research Foundation and Georgia Technology Institute. These institutions will provide senior investigators (post-doctoral scientists and engineers) to solve specific problems in the laboratory's technical areas. The efforts to solve the specific problems may last from several days to a year or more.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aeropropulsion Lab.

1.0002, SIMULATOR FOR AIR-TO-AIR COMBAT SYSTEM RESPONSE

W.J. HOPKINS, U.S. Air Force, Human Resources Laboratory, *Chandler, Arizona* 85224 (DF223400)

To document the performance of the simulator for air-to-air combat's six-degree-of-freedom motion system and to investigate and describe the motion platform drive algorithms and hardware.

Accelerometers will be affixed to the motion platform. Specified sinusoidal and step inputs will replace selected pilot control inputs to determine flight equation and motion system frequency response amount of lag and to assess motion system fidelity during selected maneuvers. The results of this work will provide the basis for software/hardware modifications to the motion system to improve training. They will aid in the interpretation of training effectiveness studies and motion system evaluations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

1.0003, IDENTIFY DESIGN AND DEVELOPMENT AND CRITERIA FOR QUALIFYING AIR CARRIER AIRCRAFT TIRES FOR SAFE OVERLOAD

UNKNOWN, Lockheed Aircraft Corporation, *Burbank, California* 91503 (FA77WA-4069; FA160423 (TRAIS NO.))

The air carrier tire performance history of air carrier operations during the years 1973 through 1976 shall be analyzed to establish the typical operating scenarios during which the main or nose wheel tire fails and overloads the companion tire/wheel assembly. The operating scenarios shall include taxi, takeoff, climb/cruise, landing, taxi modes and associated tire deflection and temperature and wheel load/speed variables.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0004, IDENTIFICATION OF KEY MANEUVER LIMITING FACTORS

I.L. ASHKENAS, Systems Technology Inc., *Hawthorne, California* 90250 (DF136880; F33615-76-C-3072)

Several high-performance combat aircraft involving aerodynamic stability and control and flying qualities exhibit factors that severely limit their maneuverability. The objective of this effort is to study the characteristics of these aircraft to determine key high-angle-of-attack maneuver limiting factors and postulate solutions for these limitations.

Analysis of high-angle-of-attack aerodynamic data, flight test time histories, and operational experience will be conducted on several aircraft to identify key high-angle-of-attack maneuver-limiting design methodology will be postulated to alleviate the limiting conditions based on identified parameters. The results will be validated and further investigated in a manned simulation of the aircraft and control system dynamics used in the analysis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0005, OPTIMAL COMPUTER-AIDED CONTROL ANALYSIS/SYNTHESIS METHODS

R.F. WHITBECK, Systems Technology Inc., *Hawthorne, California* 90250 (DF139470; F33615-77-C-3026)

Current design practice for digital flight control systems is to first develop a good analog design and then emulate it digitally. This leads to high sample rate systems with problems of computation time delays, excessive word length requirements and internal noise. One dominant reason for the current design procedure is reliance on system design criteria postulated for analog systems. The objective of this effort is to develop flight control design criteria applicable to direct digital design theory in order to take better advantage of digital system characteristics. Flying qualities and the total system's sensitivity to uncertainty in definition of the airplane's characteristics are dormant considerations in the development of new design criteria for digital systems. This effort will provide design criteria for future military aircraft flight controls that will insure optimum use of digital flight control advantages, considering both cost and performance, while providing adequate flying qualities for the mission.

The latest direct digital design methodologies including discrete optimal control theory will be reviewed and codified regarding their applicability to the design of complex aircraft flight controls. Various sampling rates and types of sampling as well as different types of data holds will be considered. Current flying qualities design criteria will be reviewed and evaluated with respect to their applicability or compatibility with digital control design theory. Revision or replacement of flying qualities criteria will be recommended where possible. Research to develop new criteria or merge flying qualities and digital control criteria will be defined where necessary. Proposed new or revised design criteria will be validated by application to realistic advanced flight control design problems and evaluation of the results.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0006, NAVY VEHICLE DESIGN AND CONSTRUCTION - IDENTIFICATION OF AIRCRAFT STABILITY AND CONTROL DERIVATIVES

W.E. HALL, Systems Control Incorporated, *Palo Alto, California* 94306 (DN223377; N00014-72-C-0328)

Research into advanced parameter identification technology is being performed. The objective is to develop new analytical methods upon which to implement expanded on-line and off-line parameter identification algorithms for extracting values of aircraft stability and control parameters from flight test data. The need for such technology stems from the requirement to reduce costs associated with design, testing and certification of military aircraft; provide input to ground simulators, and provide a basis for advanced flight control system design.

High-angle-of-attack flight test data from tests performed using the Naval Air Development Center's (NADC) variable stability T-2C aircraft will be processed using the nonlinear systems identification algorithms develop under this project.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

1.0007, COMPRESSOR SHROUD SEAL

J.W. VOGAN, Internat. Harvester Company, *San Diego, California* 92101 (DF459960; F33615-77-C-2022)

Determine energy transfer between a stator and drum rotor during a rub.

Perform rig-type testing using different (1) rub materials, (2) blade materials, (3) interaction rates/incursions, (4) rotor speeds. Perform an analysis on the heat generation and include this in the NASA rub energetics program.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aeropropulsion Lab.

1.0008, DEVELOPMENT OF AN EMERGENCY PLAN FOR AIRPORTS

UNKNOWN, U.S. Dept. of Hlth. Ed. & Wel., P.H.S., *Washington, District of Columbia* (FA77WAI-749; FA160050 (TRAIS NO.))

A draft Emergency Plan shall be developed for the air carrier airports in the Great Lakes Region. The plan shall include the data bank, responsibilities of each agency/personnel and the most effective rescue procedures for each airport to implement in case of an emergency occurring at an airport or in between airports. Versatility and flexibility should be incorporated into the plan to meet emergencies involving various aircraft sizes. Upon completion of the plan an airport will be selected in the Great Lakes Region to conduct a simulated crash rescue operation in accordance with the plan.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0009, RESEARCH ON TURBINE ENGINE CONTROL SYNTHESIS MODIFICATION

S. ARNETT, Bendix Corporation, *South Bend, Indiana* 46620 (DF455490; F33615-75-C-2042)

Under the provisions of AF contract no. F33615-72-C-1716, a highly versatile, research-type externally programmable engine control system was developed and installed in test cell number 21 of the AF Aero-Propulsion Laboratory's (AFAPL) facility complex. To accomplish the needed computation function, it employed the AFAPL's IBM 1800 digital computer, located nearby. As part of its continuing effort to improve its in-house technical capabilities, the AFAPL has undertaken to expand the test control and data acquisition role to be played by digital computers in its facilities. As a result, a 'MODCOMP II' mini-computer is being added to the test cell in which the control system of 1.1 above is installed. The 'MODCOMP II' does not, however, simply 'plug into' the existing system. Changes to the present hardware, software, circuitry, etc., are needed to accommodate this new computer and to effectively employ its capabilities. In view of the foregoing, it is the objective of this program to modify the existing system as necessary to accommodate the addition of the 'MODCOMP II' and to effectively employ the capabilities of this new computer.

This is a program in which the contractor shall design, fabricate, install, and demonstrate the effectiveness of changes to the existing control system as provided herein. The contractor shall perform the following four tasks: (1) design study, (2) fabricate, modify and install hardware, circuitry, and software, (3) demonstrate by test the efficacy of the system as modified, and (4) update the 'operating and service manual' to reflect the system changes effected.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aeropropulsion Lab.

1.0010, OVERPRESSURE/GUST STRUCTURE RESPONSE/GUST STRUCTURE RESPONSE

G.M. CAMPBELL, Boeing Company, *Wichita, Kansas* (DF191400; F29601-75-A-1017)

The objective is to determine experimentally the effect of internal pressurization on the response of the KC-135A fuselage upper lobe frames and to correlate the resulting data with data obtained analytically using the AFWL Nova-2 computer code.

A 10-ft long section of fuselage will be modified, instrumented and installed in the 19-ft diameter thunderpipe shock tube at Sandia Laboratories, Albuquerque, New Mexico. A typical upper lobe frame in the fuselage section will be analyzed using the AFWL Nova-2 computer code to predict the response of the frame to various levels of blast overpressure for several levels of internal pressurization. Using these predicted levels of response as a guide, a series of tests will be conducted on the fuselage section in the shock tube, varying the levels of pressurization and blast overpressure parametrically. Results from these tests will provide an experimental data base for use in developing methods for generalized predictions for this type of structure. Specifically, pressure-time history test data will be used with the Nova-2 code to correlate predicted and measured strains and displacements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Weapons Lab.

1.0011, TARGET ACQUISITION MODELING FOR HELICOPTERS

C. MASAITIS, U.S. Army, Ballistic Modeling Division, *Aberdeen Proving Ground, Maryland* 21005 (DA0M4531)

To obtain a realistic model for aircraft detection by visual search and to collect data for its validation.

Most of the surveyed target acquisition models are derived by dividing the acquisition process into search, detection, and recognition. Each of these functions is further analyzed into relations of physical and physiological variables. This introduces many parameters that must be determined by suitable analysis of test data. The models depend on several variables such as those defining the search area, search pattern, visibility, contrast, apparent target size, intensity of glare, and others. The values of these variables are the required inputs to the models. Since in many cases statistics of an outcome of the acquisition effort can be more readily obtained than the values of arguments described above, a simple model that expresses the relation between target characteristics and acquisition probability in terms of empirical formulas is desired.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Ballistic Research Lab.

1.0012, PROTOTYPE YC-141B AIRCRAFT

P. MACEK, U.S. Army, Natick Research & Dev. Command, *Natick, Massachusetts* 01760 (DA0H4191)

Participate in the prototype test program to insure that the Army's interest in the C-141 critical airdrop capability is considered and that no degradation to the existing capability will result from the lengthening of the fuselage.

Review test plans, assist in the preparation of flight test cards and recommend test designs which will insure recording of test results required by the Army in its engineering evaluation of the YC-141B prototype. Review film, telemetry traces and cinetheodolite trajectory space positioning reports to determine whether the current airdrop capability of the C-141A will be

degraded as a result of its modification as the YC-141B stretch prototype aircraft. Prepare Army test requirements for the proposed government-conducted comprehensive follow-on test program.

SUPPORTED BY U.S. Dept. of Defense, Army, Natick Research & Development Command

1.0013, ANALYSIS OF GRID-REINFORCED BASES AND SUBBASES FOR PAVEMENTS AND FOUNDATIONS
G.M. HAMMITT, U.S. Army, Waterways Experiment Station, *Vicksburg, Mississippi* 39180 (DA0W8187)

To determine the performance characteristics of base and subbase layers mechanically reinforced by box-grid systems of various sizes and materials.

Conduct an analytical study to analyze the state of stress of box-grid systems subjected to airfield and highway loadings, and predict the performance on the basis of limiting deflection, stress, or strain.

SUPPORTED BY U.S. Dept. of Defense, Office Chief of Engineers, Waterways Experiment Station

1.0014, CELL TEMPERATURE COMPARATOR FOR NI CD AIRCRAFT BATTERIES
G. MAHONEY, T M I Incorporated, *Florissant, Missouri* (DF460930; F33615-76-C-2181)

Develop and demonstrate in experimental hardware an on-board cell voltage and temperature monitor unit for aircraft-type nickel cadmium batteries. This monitor shall be capable of detecting the onset of thermal runaway and providing a warning of the problem before catastrophic levels are reached.

Individual cell voltages and temperatures will be continuously scanned and the values for adjacent cells compared. If unbalance is present in excess of predetermined levels, an alarm will be activated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aeropropulsion Lab.

1.0015, MULTIPLE IGNITION, NORMAL AND CATALYTIC COMBUSTION, AND QUENCHING OF FUEL-AIR MIXTURES
F.V. BRACCO, Princeton University, School of Engin. & Appl. Sci., *Princeton, New Jersey* 08540 (DF044300; AF-AFOSR-3052-76)

AF function - advanced air-breathing engines, airborne weapon delivery and defense. Deficiency - insufficient fundamental understanding of the basic fluid dynamic, surface and chemical processes involved in catalytic combustion and lack of realistic guidelines for predicting combustor and propulsion system performance, and for solution of existing combustor difficulties. Objective - to clarify the relative influence and to formulate realistic analytical representation of the surface particle, gas phase chemical kinetic, and turbulent transport processes associated with catalytic combustion phenomena encountered in advanced air-breathing combustion engines. How work contributes - will provide additional understanding and realistic analytical modeling of turbulent reactive flow fields associated with high-temperature catalytic combustion not now available and contribute to establishing realistic guidelines and techniques for overcoming present difficulties and design criteria for efficient, stable, jet engine catalytic combustors.

Theoretical and experimental studies will be carried out of basic fluid dynamic, physical and chemical processes of catalytic combustion. Relative importance will be determined of surface physical and chemical effects, gas chemical kinetics and diffusion for various catalysts, fuels, operating conditions and geometrical configurations of monolytic (honeycomb) and packed bed catalysts over a range of operating conditions (e.g., pressure, inlet and exit temperatures, inlet velocity, fuel-air ratio) characteristics of advanced air-breathing propulsion engines. Catalysts studied will include noble metals, transition-metal oxides, rare-earth oxides, and other potential candidates for advanced catalytic combustors. Fuels used will include methane, propane and higher hydrocarbons. Measurements will be made of bulk velocity, temperature, pressure and exhaust gas composition and of composition within the reactive boundary layer on the catalytic surfaces using both conventional and Raman absorption and fluorescence laser techniques. A two-dimensional model for laminar and turbulent boundary layers with multiple gas and surface reactions will be formulated and numerical solutions obtained of the complete gas conservation equations. The experimental data obtained will be used to correlate and refine the theoretical models developed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0016, ADVANCED WING-BODY AERODYNAMIC ANALYSIS AND DESIGN PROGRAM
D.J. MACKENZIE, Grumman Corporation, *Bethpage, New York* 11714 (DF133980; F33615-75-C-3073)

Accurate aerodynamic predictions are needed for the efficient design and analysis of advanced military aircraft. The objective of this effort is to develop a computer program for theoretical predictions of surface pressures, lift, drag, and pitching moments of arbitrary aircraft configurations throughout the subsonic, transonic, and supersonic flight regime. This program will be used to supplement wind tunnel test programs and will result in reduced development costs, in addition to improving cruise and maneuver performance of military aircraft.

While practical engineering predictions exist for subsonic and supersonic flight regimes, practical three-dimensional transonic programs are lacking. The current approach will apply and further develop an existing three-dimensional transonic program in three phases. The program will be validated at each phase; the final program will be demonstrated by application to an advanced technology configuration. The feasibility of interfacing the transonic program with subsonic and supersonic programs will be determined.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0017, MODULAR LIFE-CYCLE COST MODEL FOR ADVANCED AIRCRAFT SYSTEMS
B. RACHOWITZ, Grumman Corporation, *Bethpage, New York* 11714 (DF135570; F33615-76-C-3056)

Since operational support costs comprise such a large part of total life-cycle costs, these relationships are needed in order to evaluate the cost impact of alternative candidate designs and to effectively conduct trade studies which compare the cost/performance advantages of these competing designs. The objective of this study is to determine specific parametric relationships between selected operational concepts, primary performance characteristics, and life-cycle support costs which can be used to develop a model for estimating the operating and maintenance costs of future advanced military aircraft early in the design phase of the development program.

Study will be implemented to identify, analyze and quantify the relative cost sensitivity of a range of system parameters of the kind available early in the design process. Information derived will be used to generate parametric costing techniques and methodology for determining system support costs early in the design phase of an aircraft program. Computerized mathematical/statistical analysis models and techniques will be developed. Analytical tests will be formulated, capable of determining the degree of validity implicit in these models and the accuracy/adequacy of the methods developed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0018, INVESTIGATION OF ROTATING STALL AND TURBINE HEAT TRANSFER IN AXIAL FLOW TURBOMACHINERY
G. LUDWIG, Calspan Corporation, *Buffalo, New York* 14221 (DF451440; F33615-76-C-2092)

The objectives of this program are to improve understanding of rotating stall, surge and noise in axial flow compressors, to improve and demonstrate a prototype rotating stall control system

for a J-85 engine, to apply transient testing techniques to the measurement of heat transfer rates to turbine engine components.

A combined theoretical and experimental approach will be utilized. The theoretical studies will include continued development of a unified aerodynamic-acoustic analysis of compressor flows as well as extending the stability theory to include variable annulus area, lower hub to tip ratios and supersonic rotors. The experimental work will include rotating cascade testing, J-85 engine testing, shock tunnel tests and environmental testing of Area B at WPAFB to determine what, if any, CRF reingestion problems exist.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aeropropulsion Lab.

1.0019, VARIABLE STABILITY MAINTENANCE AND UTILITY FLYING

P.A. REYNOLDS, Calspan Corporation, *Buffalo, New York* 14221 (DF131660; F33615-73-C-3051)

Limitations of ground-based simulators in providing realistic or sufficient motion and visual cues has resulted in the Air Force developing two airplanes - a variable stability NT-33 and the total-in-flight-simulator (TIFS), a variable stability NC-131H. The objective of this effort is to provide system design and modification for the improvement and extension of in-flight simulation capabilities and to provide pilot currency, technique development and capability demonstration.

Both the NT-33A and the TIFS airplanes will be utilized in in-flight activities to determine operating characteristics of modifications and simulation limitations. Subsequent flying will be conducted to maintain pilot proficiency, evaluate simulation techniques and evaluate the unique advantages of full spectrum simulation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0020, TRANSISTORIZED AIRCRAFT POWER CONTROLLERS FOR B-1 FLIGHT TEST

J. PARRELLA, Telephonics, *Huntington, New York* (DF456980; F33615-74-C-2031)

To provide solid-state power controllers for flight test on the third RDT&E B-1 aircraft.

Phase I - design and build breadboards to meet B-1 requirements test breadboards for load compatibility. Phase II - build prototypes for flight test.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aeropropulsion Lab.

1.0021, INVESTIGATION OF A WING-ROTOR INTERACTION SYSTEM FOR HELICOPTERS 13573-E

F.R. DEJARNETTE, Univ. of North Carolina, School of Engineering, *Raleigh, North Carolina* 27607 (DA0P5577; DAAG29 76 G0318)

(1) Examine and develop an aerodynamic model for the flow field generated by a downward wash of air upon an airfoil while the airfoil is subjected to various wind tunnel velocities. (2) Measure time-average values of lift and drag for an airfoil. (3) Ascertain the interference effect of a wing on the rotor. (4) Make a sizing study to determine the best wing size for a given rotor size, and (5) Measure the surface pressure distribution and locate the separation point on the wing. Relevance - this study should be applicable to improving the forward flight stability of helicopter vehicles, increase the glide angle of the helicopter and, with a rigid rotor, decrease the high mechanical vibrations now inherent with the non-rigid rotor that is presently used.

Utilize a rotor blade whirling above an airfoil in a wind tunnel. Additionally, a jet stream of air supplied through a pipe above the airfoil will be constructed and studied to determine the lift, drag and angle of attack of that jet stream on the airfoil in the wind tunnel. Studies will also be carried out on the influence of plates added to the lower wing surface on reduction of the induced drag plus the effect of jet impingement on the wing surface.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Army Research Office

1.0022, TRANSONIC WIND TUNNEL EXPERIMENTS ON OSCILLATING AIRFOILS

S.L. PETRIE, Ohio State University, School of Engineering, *Columbus, Ohio* 43212 (DF138650; AF-AFOSR-3021-76)

This work unit supports the aeroelastic evaluation of high-speed aircraft. It will contribute to the development of improved unsteady aerodynamic methods to predict aircraft aeroelastic stability and structural dynamic response. The goal is to develop a low-cost research facility to conduct unsteady aerodynamic tests on oscillating models in transonic wind tunnels, resulting in ultimate savings in the costs to design new aircraft. The presence of a national capability to make these measurements will allow the orderly development of necessary analytical methods to optimize aircraft structures for minimum weight and cost.

A contractor will be selected to survey the ambient interference in a small transonic wind tunnel without a model present. An oscillating model will then be inserted into the tunnel and studies performed to determine Mach number, Reynolds number and wall interference effects on unsteady pressure measurements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0023, RECLAMATION OF SYNTHETIC TURBINE ENGINE OIL MIXTURES

G.A. BEANE, Monsanto Research Corporation, *Dayton, Ohio* 45407 (DF458700; F33615-76-C-2037)

Develop an effective method for reclaiming overaged and used synthetic turbine engine oil mixtures.

Survey industrial reclamation techniques. Identify and resolve problem areas and technical deficiencies. Develop a reclamation technique. Feasibility of the technique will be demonstrated by restoring at least one batch of used MIL-L-7808 engine oils to satisfactory performance criteria.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aeropropulsion Lab.

1.0024, HIGH-ANGLE-OF-ATTACK SEPARATED FLOWS

T.J. CORD, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF140870)

Current Air Force fighter aircraft exhibit dangerous stall/post-stall characteristics which limit combat effectiveness and may cause loss of both aircraft and crew. Criteria based on the aerodynamic characteristics of the aircraft are being developed for use in the early design phase of future systems. The objective of this effort is to develop a fundamental understanding of the separated aerodynamic flow associated with high-angle-of-attack flight dynamics and determine suitable input to design criteria. The results of this effort help to understand the high-angle-of-attack dynamic problem thus allowing solutions to be found which will increase combat effectiveness and safety of flight for future fighter/attack aircraft. The mission to be supported is FG02, development and improvement of flight control design techniques.

A number of digital computer programs with six degrees of freedom will be used to study the sensitivity of loss of control to aerodynamic variables which may be affected by flow separation. Wind tunnel test will be planned and conducted in conjunction with AEDC, to provide improved aerodynamic math models for high-performance aircraft.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0025, VCE/CONTROLS ANALYSIS

L. CRAWFORD, U.S. Air Force, Aeropropulsion Laboratory, *Dayton, Ohio* 45433 (DF458050)

The primary objective of this program is to provide and utilize the analytical tools necessary to select variable geometry engine cycles and their controls.

Engine cycle studies will be utilized to determine performance competitive cycles that are inherently amendable to low production costs. Control stategies will be simultaneously investigated since they have a strong influence on cycle sizing. The results of the effort will be factored into 30660638.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aeropropulsion Lab.

1.0026, COMBINED ENVIRONMENTS RELIABILITY TEST

D.L. EARLS, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF136650)

Repair costs of Air Force aircraft electronics equipment attributable to environmentally induced failures have been found to be approximately 460 million dollars per year. Equipments typically fail in service six to eight times more often than expected from laboratory demonstrations. The objective of this effort is to develop a realistic but cost-effective combined environments test that could be used for both qualification and reliability test and evaluation. The use of this test in the development and acquisition of electronics equipment should significantly improve its field reliability and correlation between field and laboratory reliability.

Realistic assessment of and prediction of actual environmental conditions that equipment is subjected to in field service will be determined through acquisition and analysis of aircraft environmental data. Realistic combined environment profiles will be developed for evaluation and test of aircraft equipment for various classes of aircraft. Capability to 'fly the equipment in the laboratory' will be developed by combined environment testing under realistic temperature, airflow, humidity, altitude, and random vibration conditions representative of aircraft equipment installations. New testing standards will be generated to provide the tests required to increase the effectiveness of testing needed to assure that only reliable hardware is introduced into service.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0027, VISCOUS AND INTERACTING FLOW FIELDS ABOUT FLIGHT VEHICLES

A.W. FIORE, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF138520)

The problem is to improve the technical base in order to predict pure turbulent boundary layers and viscous interactions so that such items as pressure distribution, local velocity profiles, skin friction, and heat transfer on military aircraft and maneuvering reentry nose cones can be predetermined. The technical objective is to generate fundamental data on the characteristics of high-speed viscous and interacting flow fields about vehicles at Reynolds numbers sufficiently high so that transitional and turbulent boundary layers are present. The resulting data will make possible the prediction of separated flow fields for aircraft flying at high angles of attack.

The approach to solving these problems will be experimental efforts to gain knowledge of both two - and three-dimensional viscous and interacting flow fields. The emphasis will be on (a) transitional and pure turbulent boundary layers, (b) turbulent viscous-inviscid interacting flow fields, (c) the application of boundary layer control for the purpose of reattaching separated flows at very high angles of attack as well as decreasing the overall drag of the flight vehicles, and (d) shock-boundary layer interactions. These studies will include various types of pressure gradients, surface roughness, and wall temperature parameters. Tests will be conducted at speeds extending from transonic to hypersonic Mach numbers.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0028, PRELIMINARY DESIGN OF ADVANCED WING STRUCTURE

A. GONSISKA, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF131620)

The rising acquisition and maintenance costs of advanced aircraft structures present a formidable obstacle to the procurement and operation of future Air Force weapon systems. Development of lightweight, high-integrity, low-cost airframe structures is urgently required to reverse the current trend of materials and labor cost increases. This effort is to innovatively exploit the latest developments in the field of structures technology to reduce, by at least 10 percent, the costs of advanced USAF strategic bomber wing structures while maintaining or increasing current levels of efficiency and integrity.

A swing wing aircraft (B-1) will be used as the baseline for a preliminary design study to develop innovative structural concepts for advanced system form, fit and function requirements. New structural arrangements, materials and fabrication techniques will be exploited and integrated to establish potential cost and weight reductions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0029, STABILITY AND CONTROL PREDICTION METHODS

D.E. HOAK, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF133300)

The problem involved in accurately defining aerodynamic stability and control characteristics is critical to the successful accomplishment of both strategic and tactical combat missions. This objective is to continually examine new data and theoretical knowledge concerning the understanding and prediction of aerodynamic phenomena, with particular attention given to those aspects pertinent to stability and control. Also, an awareness of existing and potential problems in this area must be fostered to insure appropriate application of existing knowledge and to form a basis for the formulation of programs to overcome critical deficiencies.

Studies of existing and new aerodynamic theory and experimental data compilations will be implemented to establish a comprehensive technology base. Attention will be focused on vital areas in which problems exist or are forseen and in which technology is deficient. Programs will be planned, and analytical, empirical and graphical relations will be developed to improve the prediction of aerodynamic stability and control characteristics for all classes of flight vehicles.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0030, ADVANCED DIGITAL CONTROL TECHNIQUES

J.E. HUNTER, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF140210)

The advanced digital control techniques program will expand the technical credibility and data base for future Air Force advanced development programs. Many methods of modern control are not possible without the computational capabilities of a digital computer. Research programs by nature require frequent design changes, comparison of alternate design, and system fault identification. These tasks are easily accomplished digitally. With this effort we will investigate techniques based on the unique computational capabilities of digital systems and develop criteria for incorporation of precision space control into the aircraft flight control/navigation system. Operational concepts demand that commanders have the ability to exercise precise spatial control over large numbers of dissimilar aircraft in any environment. This program will address these needs.

Design, fabricate, and flight validate a digital autoland system. Develop the in-house capability to modify this restructurable system to perform flight research. Conduct advanced research on modern flight control techniques and their application to future system requirements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0031, FLIGHT PERFORMANCE ANALYSIS AND DESIGN METHODS

D.T. JOHNSON, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF136190)

In the design or evaluation of military flight vehicles performance analysis is the key item in the overall assessment. Currently methods are lacking in speed of application or are technically deficient for certain vehicle applications. To upgrade our capability and reduce costs associated with concept evaluations, this effort will provide a comprehensive performance and trajectory analysis package. The emphasis of this effort will be on the reduction of resources required to conduct performance analysis.

A fundamental library of performance programs currently exist which will be the basis of the effort. Such items as common input data and plotting will be added to existing programs; in other cases analysis will be conducted to develop small, rapidly running programs. Modifications will also be made to assure rapid rapid convergence on the solution.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0032, COMPUTERIZED PROCEDURE TO ASSESS TURBINE ENGINE NOISE/PERFORMANCE TRADES

R. MCGREGOR, U.S. Air Force, Aeropropulsion Laboratory, *Dayton, Ohio* 45433 (DF453910)

The objective of this program is to develop an effective design procedure relating aircraft engine performance and noise. The specific technical objectives of this program are: (a) to develop effective uninstalled engine noise prediction methods applicable to current and future aircraft gas turbine engines, (b) to develop techniques for the prediction of installed engine noise levels including the effects of special noise reduction devices, and (c) to develop methods to assess propulsion performance and weight penalties as a function of noise level reduction.

This in-house program is comprised of three phases. Phase 1 consists of the review and evaluation of all significant turbine engine noise prediction methods, verification of the accuracy of these methods by comparison with currently available or newly generated acoustic data, and the modification and refinement of these methods where necessary. Phase 2 consists of the development of the required techniques to interface selected noise prediction methods with existing performance and weight prediction methods as well as the development of techniques to predict the effects of installation of special noise reduction devices. Phase 3 consists of the application of the final noise-performance trade procedure to selected known systems in order to verify its effectiveness.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aeropropulsion Lab.

1.0033, STRAPDOWN GYROSCOPES APPLIED TO LOW-COST ATTITUDE HEADING SYSTEMS FOR TACTICAL AIRCRAFT, MISSILES, RPV, ETC.

J.M. PERDZOCK, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF128730)

Attitude heading systems (AHS) used in current military vehicles such as the F-4, C-5A, F-111, etc., are acceleration sensitive and have marginal reliability. The objective of this program is to fabricate in-house a body-mounted gyro accelerometer package that can perform as an AHS and yet the design shall be such that an improvement in cost of ownership, increased reliability and maintainability should be achieved over the current AHS in use.

The approach to be used for this in-house effort will be based on using strapdown gyros that are capable of being torqued at a high rate without degradation of performance. Two each, two-degrees-of-freedom gyros are to be mechanized with an in-house digital computer that will simulate an all-attitude gimbal system. The platform (inertial measuring unit) is to be laboratory tested and finally flight tested for establishing the operational profile of the system.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0034, AIRCRAFT PARAMETER EXTRACTION USING UNSTEADY AERODYNAMIC FORCE MODELS

W.R. WELLS, Wright State University, Graduate School, *Dayton, Ohio* 45431 (DF139660; AF-AFOSR-3220-77)

This work unit supports the AFFDL/FGC basic research plan that is intended to provide experimental methods to validate theoretical unsteady aerodynamics. The identification of these experimental unsteady aerodynamics will provide for safer control of aircraft flight. The specific objective of this unit is to develop a parameter estimation procedure for unsteady aerodynamic terms associated with body fixed axis system motions. Results maybe incorporated into flexible aircraft parameter estimation procedure in FY-78 time period. When these experimental data are better estimated and incorporated, the aircraft response to conventional and advanced control systems will be more predictable.

State equations of symmetric motion of an aircraft's body fixed axis system are to be developed from fundamental solutions of partial differential equations of potential flow. The aerodynamic parameter of a, b(t), c in the state equation dx/dt equals ax(t) plus b(t)x(t) plus cu are then estimated for linear and nonlinear equation cases.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0035, ADVANCED TECHNOLOGY WING STRUCTURAL COMPONENT

W.A. POINDEXTER, L T V Aerospace Corporation, *Dallas, Texas* 75222 (DF138220; F33615-76-C-3138)

Increasing acquisition and life-cycle costs of aircraft have focused attention on the development and demonstration of new airframe structures technology which will provide reduced ownership cost while improving structural durability and vehicle performance. The objective of this effort is to demonstrate feasibility of selected low-cost advanced wing box structural concepts applicable to future tactical and strategic aircraft. Design concepts will consider use of both metallic and composite materials coupled with innovative design approaches. Program results will provide candidate technology and hardware demonstrated structural alternatives for advanced development and future systems application.

Structural wing box components representing a 10 ft. inboard section of a variable-camber supercritical wing configuration will be designed, fabricated, and tested to show concept feasibility. Acquistion, maintenance, and repair cost comparisons will be generated against conventional machined aluminum wing box structure.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0036, DEVELOPMENT OF NEW LOW-COST/LONG-LIFE MILITARY AIRCRAFT AIRFRAME BEARINGS CONCEPTS

W.F. LYNN, Boeing Company, *Seattle, Washington* 98108 (DF136130; F33615-76-C-3098)

Existing aircraft bearings are heavy and highly susceptible to corrosion when used as part of composite material hardware. The objective of this effort is to develop low-cost, lightweight aircraft bearings which are corrosion resistant and compatible when used as part of either metallic or composite material hardware. Potentially the bearings developed can result in up to a 35 percent improvement of life-cycle costs when replacing metallic with composite material hardware. Airframe bearing costs could also be reduced and weight reductions of up to 75 percent are possible with an increase of bearing maintainability and reliability.

Within the program various types of composite materials, lubrication combinations, and fabrication techniques will be considered. Based on these considerations reliable design and fabrication criteria will be defined from which design drawings and fabrication methods will be formulated. From these drawings a concept verification test size would be selected and a fabrication and test program pursued. Ideally, the technology resulting from the program will be directly applied to airframe joints whereby components could be submitted for appropriate specification qualification.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0037, SUPERSONIC FAVORABLE AERODYNAMIC INTERFERENCE APPLICATIONS

H. YOSHIRHARA, Boeing Company, *Seattle, Washington* 98108 (DF139990; F33615-77-C-3056)

Advanced military aircraft capable of sustained cruise at supersonic Mach numbers offer the prospects of substantially im-

proved effectiveness in the tactical, strike, reconnaisance and interceptor roles. Current military systems cannot achieve supersonic cruise at economical power settings. The objective of this effort is to judiciously apply the concepts of faborable aerodynamic interference to produce an airframe, compatible with pilot/canopy, engine and fuel requirements and capable of sustained supersonic cruise at efficient power settings.

The contractor will develop the aerodynamic characteristics of a highly efficient supersonic aircraft design. He will then apply the concepts from several aerodynamic favorable interference schemes to obtain a substantial increase in the aerodynamic efficiency at supersonic Mach numbers. Configuration iterations will be carried out. The effort will be totally analytic in assessing the benefits of favorable aerodynamic interference.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, NAVIGATION - SUPPORT FOR SATELLITE NAVIGATION SYSTEMS AN/WRN-4

J. STELLE, Magnavox Company, *Fort Wayne*, *Indiana* 46804 (DN123404; N00014-71-C-0175)

Advance design satellite navigation equipments model AN/WRN-4 have been procured in limited quantity to provide high-accuracy, all-weather, global positioning capability required to support at-sea R&D efforts. These systems are fully automatic, completely integrated, compact in size and lightweight to facilitate transfer between users while preserving high reliability and maintainability. Centralization of spare parts and repair facilities for those sophisticated and unique equipments assures continued quality control, accurate performance history and minimum investment in back-up spares.

The investigator will provide a bonded warehouse for maintaining a pool of spare parts purchased under nr 083-260; will provide a supervisor to maintain liaison with equipment users in equipment trouble shooting and spare parts replacement; will maintain inventory records, parts failure analyses and equipment performance data; will ensure timely repair of faulty parts, their inspection and their return to stock in accordance with proposed procedures, with funding limitation prescribed; will maintain three GFE model AN/WRN-4 (MX706MA) equipments for emergency back-up equipments spares; and will provide support for software modifications required as specifically directed.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, PHYSICAL METALLURGY OF BETA-TITANIUM ALLOYS

S.M. COPLEY, Univ. of Southern California, School of Engineering, *Los Angeles*, *California* 90007 (DF039810; AF-AFOSR-2766-75)

AF function - the need for a low-density replacement for nickel-base alloy disks and blades in the terminal stages of compressors in gas-turbine engines has been pointed out in Air Force research objective 2.1.1.2. Opportunity - precipitation-strengthened beta-titanium alloys are a promising new type of alloy that warrants further investigation as a potential replacement alloy. However, very little is known about the physical metallurgy of such alloys. Objective - this research will obtain an understanding of phase equilibria and the interrellationship of microstructure and properties in beta-titanium solid solutions strengthened by the precipitation of intermetallic compounds. How work contributes - this understanding is essential to fully assess their potential as gas-turbine materials and, if warranted, to facilitate their development for high-temperature applications.

Specifically, this is a basic investigation of phase equilibria in the Ti-(V, Mo, Cr)-Al-(Si, Ge) quaternary system. Of particular interest are the stability limits of the beta solid solution and the boundaries of the beta-gamma (TiAl) phase field. The approach includes microstructural analysis employing techniques such as transmission electron microscopy, X-ray analysis and electron probe microanalysis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0002, ROTATING VALVE FOR VELOCITY COUPLED COMBUSTION RESPONSE STUDIES

R.S. BROWN, United Technologies Corp., *Sunnyvale*, *California* 94088 (DF047200; F49620-77-C-0048)

AF function - solid propellant rocket motors are a cost-effective propulsion system for strategic and tactical weapons. Deficiency -definitive methods of characterizing velocity coupled combustion instabilities in rocket motors are not available. Objective - this program will explore the rotating valve method to measure velocity coupled combustion effects. How work contributes - successful development of this technique will provide a laboratory method for measuring this propellant property. This property can then be used in motor design studies, together with other data, to estimate the probability of the appearance of spontaneous pressure oscillations.

Velocity oscillations of controlled frequency and amplitude may be generated in a test motor by simultaneously operating rotating values at each end of the motor, 180 degrees out of phase. Analytical studies will improve the accuracy of the transient ballistics model, explore its limitations, and estimate the effects of experimental uncertainties. Concurrent experimental studies will construct the apparatus, compare its performance with predictions under controlled cold flow conditions, and assess the apparatus performance and appropriateness of the method by conduction combustion tests.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0003, NONEQUILIBRIUM PROPERTIES OF EXHAUST PLUMES

M.C. BRANCH, Univ. of Colorado, Graduate School, *Boulder*, *Colorado* 80302 (DF045970; AF-AFOSR-3103-77)

AF function - many future tactical rockets will require smokeless propellants. Deficiency - such propellants currently do not meet performance or stability requirements. Objective - this effort will measure the spatial and size concentrations of well characterized laboratory jets. How work contributes - analytical models of low-signature low-altitude plumes will be compared with this data for modification of plume prediction codes.

Measurements will be taken of the major stable species, temperature, particulates and electron concentrations. The measurements will be taken at the exit plane of the nozzle and will be spatially resolved throughout the exhaust plume. The exhaust plume will be studied by high-speed cinematography. Stable species will be measured with a reporting gas chromatograph and water-cooled sampling probe.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0004, NAVY ENVIRONMENT - ENVIRONMENTAL EFFECTS IN STRESS CORROSION CRACKING IN ALUMINUM ALLOYS

R.T. FOLEY, Amer. University, School of Arts & Sciences, *Washington*, *District of Columbia* 20016 (DN475438; N00014-75-C-0799)

The objective of this task is to clarify the role of environmental factors in stress corrosion cracking of aluminum alloys used in naval aircraft and craft.

An experimental program is to be conducted to study the effect of various anions in pitting initiation in aluminum alloys, a

study of local solution chemistry in these alloys, and a testing phase to correlate the first two approaches with susceptibility of the alloys to stress corrosion cracking. Standard electrochemical and fracture mechanics techniques are to be used for this study.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0005, NAVAL VEHICLES & MATERIAL SUPPORT TECHNOLOGY - RESEARCH ON FACTORS DETERMINING THE PERFORMANCE OF NAVY HIGH-STRENGTH STRUCTURAL METALS

E.A. LANGE, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN620113)

New high-strength steels, titanium, and aluminum alloys are required for use in aircraft, submarines, and surface craft of advanced design. Successful fracture-safe design with these metals requires development and standardization of practical characterization test methods for quantitative definition of fracture. The objective of this work is to develop quantitative laboratory methods for characterizing fracture resistance and to develop analysis procedures for predicting structural performance.

Investigations concerning the effects of specimen design impact velocity will be conducted in support of ASTM standardization of the dynamic tear test. Develop improved analysis procedure for defining fracture states of dt temperature transition curves. J-integral fracture characterization procedures will be studied to establish applicability of the method for quantitative definition of elastic-plastic and plastic fracture.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

3.0006, THEORETICAL INVESTIGATION OF THE EXCITATION STRUCTURE AND OPTICAL PROPERTIES OF TITANIUM, VANADIUM AND THEIR OXIDES

M.W. RIBARSKY, Georgia Inst. of Technology, Graduate School, *Atlanta, Georgia* 30332 (DF045830; AF-AFOSR-3108-76)

AF function - this proposed research primarily falls in the 2.1 and 2.2 research objectives which deal with basic research to identify approaches leading to the formation of new titanium alloy systems capable of sustained operation at temperatures up to 1600 degrees F. Also predictability of the effect of corrosion on the loadbearing capability of structure requires fundamental knowledge of chemical, electrochemical, mechanical and metallurgical influences, and their interaction. Further research is needed to understand and prevent degradation of a broad range of materials exposed to oxidizing environments at elevated temperatures. Deficiency - potential future high-performance Air Force aircraft are forecasted to be operating at higher dynamic pressures and temperatures. Continued use of aluminum alloys to fulfill future objectives remains an attractive economical approach; however, alloy systems of titanium, steels and superalloys which feature improved resistance to repeated high stress at high temperatures are needed. Objective - to study the electronic excitation structure of the transition metals and their compounds. The study will include the effects of correlation of the excited electron with the surrounding medium, relaxation of the electrons around the hole left by the excitation, and the interaction of the excited electron with its hole. Recent results have shown that all of these effects must be included in order to obtain a detailed understanding of the materials. Contribution - this research is a part of a comprehensive program in statistical mechanics.

The approach taken by this proposal is to investigate the properties of transition metals and their compounds, especially the oxides, with calculations centered around the excitation structure including correlation, relaxation and particle - hole interactions. These effects have to be included if understanding of the contributions of the localized d-band to the excitation structure is to be made, and in turn the method contemplated will provide a good description of the d-bands. The proposed program will start with calculations on titanium and vanadium and their oxides since these materials involve the simplest transition metals. The calculation will include investigations of the optical properties, lattice dynamics and electrical conductivity of these materials.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0007, DETERMINATION OF THE ACOUSTIC RESPONSES OF SOLID PROPELLANTS BY THE IMPEDANCE TUBE METHOD

B.T. ZINN, Georgia Inst. of Technology, School of Aerospace Engin., *Atlanta, Georgia* 30332 (DF037420; AF-AFOSR-2571-73)

AF function - many current and future Air Force weapons systems rely on solid fueled rockets as a method of propulsion. Deficiency -combustion instabilities in solid rockets can modify the propellant's burning rate and thus adversely affect the mission. Objective - this research will develop a new technique for measuring combustion instabilities based upon the classical impedance tube method which will predict the conditions for the onset of combustion instability. How work contributes - the results of this work will permit the design of more accurate and reliable rocket weapons.

This work will develop the experimental techniques necessary to apply impedence tube methods in determining the response factors of both stable and weakly instable propellants which cannot currently be measured. The frequency and growth rate of oscillations will be controlled such that the driving capabilities of tested propellants will be determined under identical test conditions. This experiment can also determine the responses of a burning solid propellant at different frequencies and determine the acoustic damping by solid phases of the propellant.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0008, FULL TEMPERATURE RANGE FASTENER AREA PROTECTION OF NAVAL AIRCRAFT

R.N. MILLER, Lockheed Georgia Company, *Marietta, Georgia* 30060 (DN230021; N00019-74-C-0267)

To obtain a protective system, including organic coating components for controlling the corrosion in fastener areas of naval aircraft under environmental conditions experienced during deployment with the fleet.

A laboratory investigation to develop and evaluate effective methods for protecting fasteners under a wide range of exposure conditions will be undertaken. Several protective systems will be subjected to a simulated flight spectrum. Coatings will be modified to compensate for significant performance deficiencies and then applied to selected aircraft deployed in the fleet.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0009, STRESS CORROSION CRACKING OF HIGH-STRENGTH ALUMINUM ALLOYS

E.N. PUGH, Univ. of Illinois, School of Engineering, *Urbana, Illinois* 61801 (DF046670; AF-AFOSR-3175-77)

AF function - hydrogen embrittlement is a serious problem that causes mechanical property degradation in our most significant aircraft materials including steels, titanium, aluminum and nickel-base alloys. Opportunity - hydrogen-related phenomena are suspect of playing key roles in the mechanisms of stress corrosion cracking, subcritical crack growth, hot salt corrosion, weld cracking, temper embrittlement, fatigue crack growth, and brittle fracture in general. Objective - this investigation will identify the role played by hydrogen in stress corrosion cracking of high-strength aluminum alloys through brittle film analysis, crack growth studies, hydrogen permeation studies, and hydrogen charging experiments. How work contributes - the various forms of hydrogen-related mechanical property degradation severely restrict the serviceability of important aircraft materials. Basic understanding of the manner by which hydrogen acts to reduce mechanical strength and cause failures is important if we are to minimize and control these forms of attack.

Specific emphasis will be placed on the role of hydrogen in the intergranular stress corrosion cracking of high-purity Al-Zn-Mg ternary alloys (7000-series model). The research will pursue four major issues: the possibility of hydride formation as a brittle film on fracture surfaces, hydrogen diffusion in the grain boundary region ahead of the crack as the rate-limiting step in the cracking process, and control of the diffusion process by modifying the microstructure, correlation of crack velocity with direct measurements of hydrogen diffusion, correlation of hydrogen concentration to ductility loss.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0010, EFFECTS OF SURFACE ACTIVITY ON THE NOTCH FATIGUE OF ALUMINUM ALLOYS
B.L. AVERBACH, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (DF042310; AF-AFOSR-2924-76)

AF function - aircraft structures have been and will continue to be made primarily of high-strength aluminum alloys. Deficiency - one of the design parameters limiting the full exploitation of these alloys is the notch-fatigue strength. Impressive increases in yield, tensile, and smooth bar fatigue strength have been made by various treatments and additives; however, the notch-fatigue strength scarcely improves at all. On the other hand, notch-fatigue is greatly influenced by the ambience. Objective and how work contributes - this research will study the influence of ambient atmospheres on the notch-fatigue of aluminum in order to determine why the propagation of a crack is only partially dependent on the yielding phenomena at the head of a crack and is influenced greatly by surface phenomena.

In this study, the influence of various environments and impurities on the surface active states affecting bonding and notched-fatigue behavior of aluminum alloys will be examined by ESCA (electron scattering from X-ray photoemission).

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0011, CHARACTERIZATION OF HELICOPTER MATERIALS HARDENED AGAINST HEL RADIATION
R. FITZPATRICK, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0F4703)

The objective of this study is to establish baseline materials data on the effects of high-energy laser radiation on advanced Army materials. The materials will be hardened and the relative merits of the hardening approaches will be evaluated and compared with baseline data.

Materials presently being considered for use in advanced (1980-90) Army systems will be irradiated using high-energy laser devices, operating at 10.6. The materials to be evaluated will include polymers designed for use in both skin structures and canopies, ceramics designed to afford ballistic protection, and high-strength alloys that are to be used in the drive trains of rotary-wing aircraft. Testing will be done on high-powered devices that have well defined high-quality beam profiles. The relative merits of the hardening schemes employed will be measured as a function of burnthrough time. The hardening schemes that will be evaluated initially will include reflective coatings on ceramic and metal systems, high char forming structural foams, clean ablative skins and intumescent coatings on composite samples.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Materials & Mechanics Research Center

3.0012, FUNDAMENTALS STUDIES IN OPTICAL MATERIALS
H. POSEN, U.S. Air Force, Rome Air Development Ctr., *Rome, New York* 13440 (DF902930)

AF function - fundamental studies and improvements in optic materials and components required for C3 applications. Deficiency - need to identify and establish the structure, properties, and potential of optical materials and components required for cost reduction, reliability, and stability of C3 systems. Objective - to study the chemistry and physics of optical materials with emphasis on thin films for integrated optics, fiber optics and nonlinear optics. How research contributes - this work is in direct support of programs underway in the electrooptical device groups of the laboratory, and in support of the LQ-10 program.

Investigations will be conducted into new techniques for surface preparation, new techniques for thin film preparation, establishment of optimum conditions for epitaxial optical film preparation, studies into techniques for strengthening and hardening of fiber optics, and other fundamental studies as required by the electrooptical device group.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

3.0013, HIGH CRITICAL TRANSITION TEMPERATURE SUPERCONDUCTING FILAMENTS
I. AHMAD, U.S. Army, Res. Directorate, *Watervliet, New York* 12189 (DA0G1721)

The preparation of high critical transition temperature, A15 compounds, in particular, niobium sub three germanium, by chemical vapor deposition has already been demonstrated. Under this project process parameters to obtain this compound in the form of strong and flexible filaments with high critical transition temperature will be studied. main emphasis will be to investigate the effect of impurities such as oxygen, carbon, and aluminum on the stability of niobium sub three germanium. High critical transition temperature A15 compounds in the form of filaments can be made into flexible cables, which can lead to the effective utilization of superconductivity in power transmission and high field magnets at economical costs.

The necessary technique and equipment for applying coatings on continuous filaments by chemical vapor deposition have already been established in our lab. Niobium sub three germanium will be deposited by the reduction of germanium and niobium halides with hydrogen on electrically heated six mil continuous tungsten filament. The coated filament will be evaluated for stoichiometry, lattice parameter, microstructure, tensile strength and critical transition temperature, magnetic field and current density.

ADDENDA: Supporting agency address is: ARMCOM Benet Weapons Lab, Watervliet Arsenal, Watervliet NY 12189

SUPPORTED BY U.S. Dept. of Defense, Army

3.0014, THE FUNDAMENTAL DESIGN OF TITANIUM-ALUMINIDE-BASE INTERMETALLIC COMPOUNDS
E.W. COLLINGS, Battelle Memorial Institute, *Columbus, Ohio* 43201 (DF040170; AF-AFOSR-2786-75)

AF function - AFAPL requirements for turbine engine materials for an advanced tactical fighter plane for use in the 1980s present two research-oriented problems requiring solutions from the field of materials science. First, the need for materials to operate at higher engine temperatures to improve operating efficiency, and second, the need for lighter weight materials to decrease engine weight, engine operating stresses due to heavy components, and fuel comsumption. Opportunity - the needed materials must have the same density as titanium combined with the mechanical properties and oxidation resistance of nickel base superalloys. Objective - this research will establish the fundamental principles required for designing titanium aluminide intermetallic compounds with improved high-temperature strength and room temperature ductility. How work contributes - the titanium aluminides have exhibited great potential for such applications.

This will be undertaken through experimental and theoretical analysis of the effects of alloying on the bonding characteristics, particularly directionality and anisotropy, since these are responsibile for resulting strength and ductility.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0015, BEARING RESEARCH FOR PROPULSION AND POWER SYSTEMS
R.D. DAYTON, U.S. Air Force, Aeropropulsion Laboratory, *Dayton, Ohio* 45433 (DF451070)

Raise R. E. bearing capability to three plus mission dn, extend bearing fatigue life and increase steel fracture toughness through better materials, increase the understanding of the fundamentals of lubrication dynamics, and increase the capability of computer modelling of bearing operation.

Document the result of existing R. E. bearing analyses, conduct full-scale bearing tests to verify fatigue capability, perform dynamic measurements of lubricant film thickness and traction characteristics, and investigate the physical properties of lubricants needed for dynamic modelling.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aeropropulsion Lab.

3.0016, FATIGUE IN POWDER METALLURGY ALUMINUM ALLOYS
A. LAWLEY, Drexel University, School of Engineering, *Philadelphia, Pennsylvania* 19104 (DF047690; AF-AFOSR-3247-77)

AF function - the longevity, reliability and safety of aerospace structures are related to the fatigue properties of the structural materials used. Opportunity - since the fatigue properties of structural materials often limit their application, it is important to understand the mechanism of fatigue and especially the metallurgical means by which fatigue resistance may be improved. Objective - this research will establish and quantify processing-microstructure-mechanical behavior relationships in fully-dense powder metallurgy materials. Particular interest centers on fatigue response in aluminum-base alloys and includes the roles of stress state and environment. How work contributes - since aluminum alloys form a major portion of the material currently used for skin and other structural airframe applications, it is appropriate that they are the basis of this investigation.

The fundamental understanding of the fatigue behavior of powder-metallurgy-processed aluminum alloys to be developed during the course of this research will provide the basis for carrying out future alloy and process development to achieve improved materials. In addition, the principles developed during the course of this investigation should also be applicable to other age-hardening systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0017, THE CYCLIC STRESS-STRAIN RESPONSE OF HIGH-STRENGTH ALUMINUM ALLOYS AND ITS RELATION TO FATIGUE FRACTURE 12456-MS
C. LAIRD, Univ. of Pennsylvania, School of Metallurgy, *Philadelphia, Pennsylvania* 19104 (DA0H5575; DAAG29 77 G0120)

To develop an understanding of the fatigue behavior of various aluminum alloys, from pure binary aluminum alloys through structural alloys 7075 and 2024, including those prepared by the Frankford Arsenal FTMT and ITMT thermomechanical processing methods. The proposed research is relevant to a wide range of Army problems, including structural aluminum alloys employed in helicopters, land vehicles, and weapons.

Cyclic stress-strain response of the alloys is to be measured under constant plastic strain and under other modes, and transmission electron microscopy will be used to elucidate the deformation mechanisms and the associated fracture processes. The examination of the dislocation structures and various precipitate structures and morphologies will be of particular interest to those aims.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Army Research Office

3.0018, GRAPHITE INTERCALATION COMPOUNDS FOR HIGH ELECTRICAL CONDUCTIVITY 13169-MS
F.L. VOGEL, Univ. of Pennsylvania, School of Engin. & Appl. Sci., *Philadelphia, Pennsylvania* 19104 (DA0M5573; DAHC04-75-C-0022)

To examine the detailed correlation between composition and structure of compounds conductivity which result from intercalation of graphite by strong acids and their carrier concentrations and mobilities. Relevance - the research will be directly relevant to the use of graphite fibers to reinforce polymer-matrix composites for Army helicopters. Highly conducting graphite fibers would indicate damage or degradation by a decrease in conductivity when fibers break. They would also minimize the damage to the composite if there is a lightning strike. The investigator also hopes to produce a copper-matrix graphite-reinforced composite for electrical wires of lower copper content, and hence, lower weight. This is relevant to the weight/payload ratio of helicopters.

The work will include: (1) intercalation of graphite in the form of fibers or pyrolytically aligned crystals by reaction with strong acids in the liquid or gaseous phase, (2) characterization of the graphite both before and after intercalation using scanning electron microscopy, chemical analysis, and X-ray diffraction, (3) measurement of the electrical conductivity of the graphite specimens after intercalation, and (4) determination of the mechanism of conduction in intercalated graphite.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Army Research Office

3.0019, THE ROLE OF HYDROGEN IN THE STRESS CORROSION CRACKING OF HIGH-STRENGTH ALUMINUM ALLOYS
I.M. BERNSTEIN, Carnegie Mellon University, Inst. of Technology, *Pittsburgh, Pennsylvania* 15213 (DF046820; F49620-77-C-0003)

AF function - hydrogen embrittlement is a serious problem that causes mechanical property degradation in our most significant aircraft materials including steels, titanium, aluminum and nickel-base alloys. Opportunity - hydrogen-related phenomena are suspect of playing key roles in the mechanisms of stress corrosion cracking, subcritical crack growth, hot salt corrosion, weld cracking, temper embrittlement, fatigue crack growth, and brittle fracture in general. Objective - this investigation will identify the role played by hydrogen in stress corrosion cracking of high-strength aluminum alloys through determination of microstructural and fractographic correlations with cracking, direct observations of cracking, permeation studies, and mechanical tests under cathodic charging conditions. How work contributes - the various forms of hydrogen-related mechanical property degradation severely restrict the serviceability of our important aircraft materials. Basic understanding of the manner by which hydrogen acts to reduce mechanical strength and cause failures is important if we are to minimize and control these forms of attack.

Specific emphasis will be placed on the role of metallurgical variables such as precipitate type, size and distribution, to develop these as control variables for the production of high-strength aluminum alloys (7000-series) more resistant to hydrogen embrittlement and/or stress corrosion cracking.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0020, ANALYSIS OF SOLID PROPELLANT EXTINCTION AND DROPLET BURNING
A. CRESPO, Natl. Inst. for Aerospace Tec., *Madrid, Spain* (DF044750; AF-AFOSR-3049-76)

AF function - this research supports research objective 5.1 since many solid propellant missiles achieve thrust termination by rapid depressurization and significant flow field effect are present in liquid propellant motors and guns. Deficiency - thrust profiles upon termination cannot be accurately predicted and the burning of droplets under the influence of forced convection is not well understood. Objective - model the extinction of solid propellant by pressure decay and study the forced convection effects on droplet burning. How work contributes -develops prediction methods in these two areas that avoid costly experimental determinations.

This modeling in this research will include heat losses from the surface and consider the pressure decays to be rapid. Realistic asymptotic limits such as large activation energies and small heat losses will be explored to simplify the problem. The liquid droplet burning problem will consider the simultaneous influence of forced convection effects and non-steady effects.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0021, LOW-TEMPERATURE FLUORINE CHEMISTRY OF ELECTRONEGATIVE ELEMENTS
G. MAMANTOV, Univ. of Tennessee, School of Liberal Arts, *Knoxville, Tennessee* 37916 (DF046520; AF-AFOSR-3165-77)

AF function - future Air Force space explorations require improved propulsion and power systems. Deficiency - new synthesis techniques for preparing more energetic materials are needed.

Objective - the research involves cryogenic synthesis of strongly oxidizing species of fluorine and other electronegative elements. How work contributes - the research will provide new approaches to the synthesis of high-energy materials.

The use of infrared lasers for excitation of low-temperature reactions involving compounds with n-f and o-f bonds as well as fluorine will be investigated. This approach will be used to explore synthetic routes to tetrafluoroammonium salts. Other areas studied include reactions of fluorine atoms with compounds of electronegative elements in inert matrices, the use of UV photolysis and gamma-radiolysis for the production of new radicals, and radical-radical reactions in matrices.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0022, MECHANICS OF COMPOSITE MATERIALS WITH DIFFERENT MODULI IN TENSION AND COMPRESSION

R.M. JONES, Southern Methodist University, School of Engineering, *Dallas, Texas* 75222 (DF037040; AF-AFOSR-2532-73)

AF function - aerospace vehicles and rocket propulsion technology require improved understanding of the structural mechanics of composite airframes and rocket nozzles. Deficiency - substantial concern has recently been raised as to the Air Force understanding of composite structures, durability and the failure prediction of rocket nozzles. Objective - the objective of this research is to understand the implications of composite moisture and temperature behavior of plate and shell behavior and to understand and develop accurate failure models for graphite materials based on bimodular material characteristics. How work contributes - research contributes to identified research objectives 4.1 and 5.2.

Research proposed is theoretical in nature. Moisture and temperature are known to affect glass transition temperature of epoxies. This in turn changes the modulus of the material. As moisture is diffused through composite laminate a concentration gradient can be anticipated resulting in a mechanically nonsymmetric layup. This phenomenon will be studied as it affects plate and shell vibration and buckling. In addition, the failure criteria of carbon-carbon materials will be investigated based on bimodular model in biaxial or triaxial stress field. Carbon-carbon polar weave will be studied and will consider the influence of fiber volume fraction variations in the radial and vertical directions. Finally, modeling of unloading behavior will be investigated in terms of a nonlinear multimoduli material characteristic.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, AN AERODYNAMIC ANALYSIS OF DEFORMED WINGS IN SUBSONIC AND SUPERSONIC FLOW 14802-A-E

J.E. BURKHALTER, Auburn University, School of Engineering, *Auburn, Alabama* 36830 (DA0F8923; DAAG29 77 G0069)

To develop an analysis for deformed wings including camber and thickness for both subsonic and supersonic flow. Relevance - the work is highly relevant to the problem of maintaining control of missiles in extremely high g maneuvers.

Appropriate aerodynamic coefficients such as lift coefficient, induced drag, pitching moments, aerodynamic centers and hinge moments will be computed and compared with experiment where applicable. Potential flow theory will be utilized to model the basic flow field with special techniques being used to account for interference, deformations, camber, twist and thickness.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Army Research Office

4.0002, PRELIMINARY DESIGN OF SPIKE, HYPERVELOCITY KE ROCKET

L.W. LEE, U.S. Army, Missile Res. Dev. & Eng. Lab., *Huntsville, Alabama* 35809 (DA0F1278)

To establish feasibility of a hypervelocity single-penetrator rocket that may be helicopter launched, and to demonstrate this rocket's precision accuracy.

The feasibility will be established through design studies that substantiate the various required parameters of the rocket (weight, p sub wf, etc.) combined with effectiveness studies. The rocket will then be designed and produced in hardware and flight tested.

SUPPORTED BY U.S. Dept. of Defense, Missile Command, Aeroballistics Directorate

4.0003, EXCITATION OF A WIRE IN A RECTANGULAR CAVITY, PHASE II

D.G. DUDLEY, Univ. of Arizona, School of Engineering, *Tucson, Arizona* 85721 (DF050180; AF-AFOSR-3462-77)

AF function - this research proposes to continue the analysis of a wire inside a rectangular cavity from the cavity exterior through an aperture. This boundary value problem is an idealization of a wire within a metallic enclosure which resembles aircraft configurations. The objective of the research is the determination of the susceptibility of such systems to transient electromagnetic pulse (EMP) excitation. This work will contribute to the analytical efforts of the AF EMP program. Opportunity - by performing a careful investigation of the ideal wire/cavity problem, it should be possible to establish the theory and obtain characteristic data needed to provide a foundation for predicting the electromagnetic response of the wire and the region within the enclosure of a practical system. Objective - to determine the susceptibility of a wire inside a cavity to transient electromagnetic pulse (EMP) excitation. Contribution - this work will extend previous analyses of the electromagentic response of the wire/cavity system.

The assumptions and conditions of the wire/cavity problem to be investigated are: (1) the cavity is the interior region of a perfectly conducting rectangular box, (2) the material inside the box is uniform, linear and isotropic, (3) the cavity is excited through a small hole (aperture) in the wall of the box. The hole may be located on any wall and the electric field in the aperture is specified, (4) the wire is circular and perfectly conducting and it is oriented with its axis perpendicular to a side wall of the box, (5) the wire may be loaded, uniformly and/or lumped loaded, and its ends may or may not be in electrical contact with the side walls to which the wire is perpendicular, (6) the wire is thin at the frequency of operation and thin wire assumptions will be utilized, and (7) previous calculations will be modified to create a formulation lending itself to the analysis of transient input waveforms.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0004, HYPERSONIC HEAT TRANSFER MEASUREMENTS

B.E. RICHARDS, Von Karman Inst. for Fl. Dyn., *Brussels, Belgium* 1640 (DF042600; AF-AFOSR-2942-76)

AF function - aerospace vehicles. Deficiency - unpredicted or poorly predicted transition from laminar to turbulent flow on the nose tips of ABRES shapes has caused numerous severe problems of heating and aerodynamic instability. Ground based flow facilities do not simulate all of the flow parameters of free flight that influence these phenomena. One facility, which is rather economical to operate, located at the VKI, Brussels, is capable of simultaneous simulation of Mach number and Reynolds number of these flights, while not achieving the sustained, realistic running time. Nevertheless, heat transfer and pressure distribution measurements on a number of nose tip shapes of interest to ABRES appears to be desirable. Objective - to extend and confirm data previously obtained by VKI with Avco support and coordination, using models manufactured under a previous program. How work contributes - the results of this experimental program will help with the design of nose tips which ameliorate the problem attended to under Deficiency.

The longshot facility of the VKI will be used for this program. Surface pressure and heat transfer measurements will be made at

Mach numbers of 15 and 20 and free stream Reynolds numbers between 2 and 8 million per foot. Models to be tested include a concave biconic nose tip model with and without roughness.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0005, RESEARCH AND DEVELOPMENT ON CAPACITORS FOR AIRCRAFT HIGH POWER

R. PARKER, Hughes Aircraft Company, *Culver City*, *California* 90230 (DF457650; F33615-75-C-2021)

The objective of this program is to develop capacitor technology in two performance regimes. One regime is characterized by small capacitors operating at several hundred pulses per second (hi-rep) and 15 kilovolts. The other regime is characterized by much larger capacitors operating at several tens of pulses per second (lo-rep) and 40 kilovolts. The performance regimes are sufficiently different that it is unlikely the same dielectric system will satisfy both regimes. Although the dielectric systems may be different, design philosophy and techniques, and manufacturing methods are expected to be common to the capacitors of both regimes. Eventual use of both capacitors is likely to be in pulse forming networks (PFN) so that the capacitors may have to operate in a square pulse mode.

The contractor shall provide all materials, services, and equipment for the completion of this program. During the first portion of the program, the contractor will select the dielectric systems and conduct pad tests to establish a firm base for achieving the required capacitor performance. As part of the pad development effort, the contractor will determine the feasibility, desirability, and advantages of winding capacitor pads which contain no kinks or wrinkles. Upon completion of the pad tests, the contractor will design, fabricate, and test both hi-rep and lo-rep capacitors to demonstrate the required performance. An outline of the program tasks is (1) dielectric systems selection, (2) pad design, (3) wrinkle-free capacitor pads, (4) capacitor designs, and (5) capacitor fabrication and test.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aeropropulsion Lab.

4.0006, ANALYTICAL METHODS USED IN THE EVALUATION OF THERMAL PROTECTION SYSTEMS FOR REENTRY VEHICLES

A.F. MILLS, Univ. of California, School of Engin. & Appl. Sci., *Los Angeles*, *California* 90024 (DF042450; AF-AFOSR-2931-76)

AF function - advanced ballistic reentry systems (ABRES) design and development. Deficiency - radiant and convective heat transfer and ablative shape change depend strongly upon the behavior of laminar to turbulent flow transition on reentry nose tips. This area is the subject of intensive research activity by a number of investigators since understanding of the field is not satisfactory. The field is somewhat hampered by the fact that no systematic compilation of the state of knowledge in it exists in the form of a monograph or textbook which can be used by the beginning engineer or junior officer taking on technical responsibilities for reentry system design and development. Objective -to provide a monograph which can be used for instruction as well as a reference work to fill the need stated. How contributes - a set of lecture notes, prepared for a series of lectures engaged by a prominent aerospace company for the instruction of its technical personnel working in this area, will be expanded and used as the outline for a monograph which will be made available for wide distribution within the aerospace community to fill this reference need among engineering personnel.

A systematic review and evaluation of analytical methods used in the heat and mass transfer analysis of thermal protection systems for reentry vehicles is to be made. Extension of the current methods to include recent observations and data will be made where possible.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0007, ANALYSIS AND DESIGN OF FAULT-TOLERANT COMPUTER SYSTEMS

J.P. HAYES, Univ. of Southern California, School of Engineering, *Los Angeles*, *California* 90007 (DF049080; AF-AFOSR-3352-77)

AF function - to promote the design and theory of fault-tolerant computers, and their diagnosis and reconfiguration in a computer network. Deficiency - increasing demands are being placed on microprocessors and minicomputers for real time applications such as controlling the aerodynamic surfaces of aircraft. There is an urgent need for methods for designing such systems so that if a fault occurs, the overall system will still operate satisfactorily. Objective - to develop better models and procedures for the recovery and configuration of a computer network when a fault has been diagnosed. How work contributes - the results of this research will be of great importance in designing future microprocessors which will satisfy the requirement for ultrareliable computing.

A graph model of computer network has been devised. This model has been shown to be valuable for the study of fault diagnosis. The work will be extended to achieve a larger model which can be used effectively to study the best ways to carry out the necessary reconfiguration and recovery after a fault is discovered. The properties of bit-sliced microprocessors will be investigated that relate to their reliability and fault tolerance.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0008, ENGINEERING SERVICES

UNKNOWN, Teledyne Systems Company, *Northridge*, *California* 91324 (FA77WA-3945; FA160249 (TRAIS NO.))

The contractor shall furnish engineering services and technical assistance to assist the Government as may be required in the initial checkout of the system to insure proper system operation and further to provide maintenance of the equipment. Engineering personnel assigned by the contractor to perform the services shall be thoroughly familiar with the design of the system and shall have the experience and knowledge to perform the services capably and efficiently.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

4.0009, SYSTEM MODELING AND STATISTICAL DATA PROCESSING

T. KAILATH, Stanford University, School of Engineering, *Palo Alto*, *California* 94305 (DF038860; F44620-74-C-0068)

AF function - to advance the design of electronic communications, control and sensor systems needed by the Air Force. Deficiency - the classical methods in circuit design are not sufficient for the modern digital integrated circuit types of filters, and increased demands for sophisticated capabilities require better algorithms for signal processing. Objective - to develop new techniques in estimation and detection, to exploit the results of scattering theory to least squares estimation, and to extend the theory of nonstationary processes. How work contributes - success in this program would substantially increase the signal processing capabilities of future Air Force systems.

Work will continue in the areas of fast algorithms, scattering theory, multivariable systems theory, and innovations processes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0010, DYNAMIC SYSTEMS

D.G. LUENBERGER, Stanford University, School of Engineering, *Palo Alto*, *California* 94305 (DF046370; AF-AFOSR-3141-77)

AF function - the design and integration of electronic systems and aerospace vehicles. Deficiency - the optimal design of complex systems is hampered by the problems of effectively interfacing constituent parts and subsystems. Although the state space basis of dynamic systems and their optimal configuration are now well developed, the application of these principles to even moderately complex problems is often too difficult for cost-effective implementation. Objective - to develop systematic theo-

ries of approximations, and to unify the existing useful design methods that have evolved from ad hoc ideas. How work contributes - progress achieved in this area would permit more sophisticated and powerful systems to be designed and built in a cost-effective manner.

The initial efforts will consider three interrelated projects -- positive systems, aggregation, and information simplification. Positive systems arise frequently in practice, and the theory is the most advanced here. Therefore, the known results can serve as a standard for comparison in treating other systems. The theory can be used as a tool also in investigating the long-standing problem area of aggregation. The topics of information simplification can be attacked by methods of aggregation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0011, COMPUTING METHODS FOR THE APPROXIMATE SOLUTION OF TIME-DEPENDENT PROBLEMS

J.E. OLIGER, Stanford University, School of Hum. & Sciences, *Palo Alto, California* 94305 (DN575403; N00014-75-C-1132)

Time-dependent boundary value problems in fluid mechanics are, as a class, the most difficult problems in computational mechanics. It is often not clear how to properly formulate the mathematical form of the problem, theory is not yet an adequate guide to choosing well behaved solution procedures (algorithms), and often either inadequate or inaccurate data must be used to drive the chosen algorithm. These problems are particularly acute in geophysical fluid mechanics, a subject area of increasing interest to the Navy because of increasing dependence on numerical weather forecasts and numerical models of oceanographic phenomena. Often, understanding of oceanographic phenomena is only available through numerical models.

This research will extend the so-called Kreiss-Oliger stability theory to larger classes of problems. It will also investigate the numerical well posedness of problems in geophysical fluid mechanics and attempt to find well posed formulations which use the types of data which are available from modern sensors, e.g., those used on bservational satellites.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0012, ENVIRONMENTAL NOISE DATA SYSTEM

R.S. GALES, U.S. Navy, Ocean Systems Center, *San Diego, California* 92152 (DN588596)

Validate methodology and instruments for acquisition of environmental noise data in the vicinity of air installations, to be cost-effective and compatible with current EPA and DOD guidelines. Determine suitability of equivalent continuous sound level (LEQ) as basic noise measure for land use planning. Recommend adjustments where needed. Optimize procedures for application of LEQ criteria.

Test portable noise monitoring equipment with direct digital printout. Compare utility, cost and reliability with that of conventional instruments. Investigate influence of local topography and weather on noise. Investigate utility of a continuous noise monitor system for a naval air station. Compare alternative monitor equipments. Develop benefit-cost matrix for evaluating alternatives for procurement. Utilize NAS Miramar as a test bed for an experimental continuous monitor system. Analyze NAS Miramar operations data to specify average busy day. Conduct controlled laboratory listening tests with recordings to determine helicopter blade-slap and ground run-up corrections. Investigate adequacy of current construction criteria based on LEQ by measurements on existing structures.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Facilities Engineering Command

4.0013, WAVE INTERACTIONS IN TRANSONIC AND HYPERSONIC FLOW

N.D. MALMUTH, Rockwell International Corp., *Thousand Oaks, California* 91320 (DF042740; F44620-76-C-0044)

AF function - advanced aerospace vehicles. Deficiency - analytical methods are limited in accuracy and range of validity. Objective -better understanding of wave interactions in transonic and hypersonic flow as they pertain to (1) wing body interference, (2) refraction, reflection and diffraction processes occurring in nonlinear wave propagation in steady and unsteady flows, and (3) wind tunnel wall interference at transonic speeds. How contributes - better understanding of wave interactions will allow engineers to more accurately predict performance of advanced aerospace vehicles and thus eliminate some presently required testing.

An analytical framework will be developed to bridge the gap between numerical and experimental flow models for transonic and hypersonic flows. Specific applications will be selected and analytical formulations developed which can later be tested numerically.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0014, SONIC BOOM - TEXAS

L. MACHTA, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (RAC40330)

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin., Systems Research & Development Service

4.0015, MINIMUM-WEIGHT DESIGN OF FUSELAGE-TYPE STIFFENED CYLINDRICAL SHELLS

G.F. SIMITSES, Georgia Inst. of Technology, School of Engin. Sci. & Mech., *Atlanta, Georgia* 30332 (DF038520; AF-AFOSR-2655-74)

AF function - Air Force flight vehicles will continue to require high-performance minimum-weight structural designs. Opportunity -automated structural optimization design techniques are under investigation in order to enhance vehicle performance. Within the field of structural optimization, the opportunity exists to pursue techniques which consider critical structural behavior phenomena in a reliable, efficient manner. Objective - the objective of this research is to investigate structural optimization under the action of compressive and torsional loadings, including the influence of imperfection sensitivity on optimum configurations. How work contributes - this research will provide understanding and approaches to the critical design conditions of stability for minimum-weight vehicle designs.

It has been well established that the discrepancy between theoretical predictions and experimental buckling results is primarily attributed to geometric imperfections of structural systems. In order to assess the effect of initial imperfections and accurately predict the load capacity of optimized structures it is important to include these imperfections in the analysis or perform postbuckling analyses. This research will initially study optimal designs based upon classical buckling analysis of perfect designs and then investigate the effect of imperfections in the neighborhood of the optimal design. Imperfection sensitivity analysis will consist of solving nonlinear equations for critical conditions in design space that incloses the optimum. Both the type and magnitude of imperfections will be studied to investigate the most critical conditions that influence the design.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0016, EQUATORIAL RADIO FADING

J.R. KOSTER, Univ. of Ghana, *Accra, Ghana* (DF241960; AF-AFOSR-2628-74)

AF function - communications, radar. Deficiency - signal fading causes high error rates. Objective - to determine the nature and extent of the destructive effects of the irregular equatorial ionosphere on signals from communications and navigation satellites. How research contributes - results are used to predict times and conditions of outages. This work extends earlier 136, 254, 140 and 360 mHz observation and analyses. Data will be used to determine propagation characteristics of communications channels. Results will be used by GPS/NAVSTAR, AFSATCOM and FLEETSATCOM systems designers.

The approach is to record and analyze VHF/UHF radio signals transmitted by satellites to illustrate and quantize destructive ionospheric effects. Data reduction and analysis are accomplished by the grantee; the coded data are also furnished for AFGL analysis. This year the work will stress analysis of group delay observations taken using the ATS-6 satellite during the year June 1975 - June 1976.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

4.0017, CONTROLLABILITY AND EVOLUTION OF COHERENT STRUCTURES IN TURBULENT WAKES

J.L. WAY, Illinois Inst. of Technology, School of Engin. & Phys. Sci., *Chicago, Illinois* 60616 (DF036430; F44620-76-C-0062)

AF function - advanced aerospace vehicles. Opportunity - gain a better understanding of the underlying concepts of turbulent wakes. Objective - to provide data for the use of predictive schemes and answer basic questions concerning the character and evolution of large-scale structures in turbulent flows. How contributes - will provide data and insight for the various sophisticated predictive schemes to be tested against prior to being used in the design of advanced aerospace vehicles.

Three contrasting basic wake geometries will be studied first, to be followed by combinations of the basic geometries that produce the most interacting flows. The experimental techniques of thermal tracing, conditional sampling and averaging, and acoustic excitation will be employed to extract information for predictive theory testing.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0018, NONLINEAR SPECTROSCOPY OF MOLECULAR GASES - FREQUENCY TUNABLE IR AND FIR LASERS

P.D. COLEMAN, Univ. of Illinois, School of Engineering, *Urbana, Illinois* 61801 (DF000190; AF-AFOSR-2988-76)

AF function - improvements in the operation of Air Force communication and surveillance equipment may be brought about by advances in electrooptical techniques and electromagnetic devices. Research on infrared optical electronics and tunable lasers in this region will contribute important results for the use of this part of the electromagnetic spectrum in communications, optical radars and diagnostic techniques. Opportunity - previous work has provided the knowledge and the facilities to develop and explore the mid- and far-infrared spectral region (10-1000 micrometers wavelength). Specific problems are nonlinear spectroscopy of molecular gases with the aim of developing frequency tunable sources, frequency convertors, and mixers. Objective - the thrusts of this work are: 1. Obtaining a frequency tunable source via nonlinear optics, 2. Obtaining a frequency tunable source by pressure broadened gain curves, and 3. Developing far-infrared integrated optics. Contribution - for many applications, low-level CW frequency tunable signals are useful. For example, in spectroscopy or resonance studies, in evaluating the bandwidth characteristics of devices, and in local oscillators these signals could be used to advantage. In other applications, high pulsed power tunable signals are needed, such as in optical pumping experiments, double resonance studies and systems applications.

Previous research has contributed important information on optical pumping and infrared integrated optics. Sufficient progress has been made to permit further studies of frequency tunable laser sources in the infrared and to develop integrated optics. This research will emphasize two different methods of obtaining a frequency tunable coherent source in the IR - far-IR spectral range along with research on integrated optics. The first method will seek a frequency tunable source via nonlinear optics. The second will search for a frequency tunable source via pressure broadened optically pumped molecular gases. The far-IR integrated optics work will emphasize a study of absorption loss in materials to identify factors which influence FIR absorption, a search for new low-loss materials, study of two-dimensional optical confinement dielectric waveguides, and integration of a metal oxide - metal diode detector into the waveguide.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0019, STANDARD ELECTRONIC MODULE RADAR

H.J. ROMAKER, U.S. Navy, Avionics Facility, *Indianapolis, Indiana* 46218 (DF102260)

This program is an initial effort to gain information on life-cycles cost reduction in avionics systems through standardization. The purpose of this program is to provide AF engineers experience in the design, development, and fabrication of avionics systems using standard electronic modules. Additionally, this effort will include the development of a radar system which can potentially demonstrate a substantial reduction in life-cycle cost through the use of standard electronic modules and automatic built-in test equipment (BITE).

The approach will be the design, development and fabrication of electronic module radars intended for airborne applications in the cargo/tanker-type aircraft.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0020, AN ANALYSIS OF TIME-DEPENDENT TURBULENT WALL LAYERS AND UNSTEADY SEPARATION IN NOMINALLY STEADY FLOW

D.E. ABBOTT, Purdue University, Purdue Research Foundation, *Lafayette, Indiana* 47907 (DF039340; AF-AFOSR-2707-74)

AF function - advanced aerospace vehicles. Opportunity - provide better understanding of the structure of turbulent flows. Objective -provide theoretical method for the treatment of the coherent structure in turbulent boundary layers. How work contributes - development of this theoretical method is the first step in developing a predictive method for turbulent boundary layers useable by aircraft designers for advanced aerospace vehicle design.

An analysis of the time-dependent three-dimensional Navier-Stokes equations applied to the near wall region of an otherwise steady two-dimensional turbulent boundary layer will be made. Asymptotic methods will be used. The form of the assumed expansions for the velocity components is suggested by an extensive survey of experimental evidence. Analytical and numerical solutions are obtained for the flow during the burst period and the resulting time-coverage velocities and Reynolds stresses are developed. A prediction method may then be formulated for the Reynolds averaged boundary layer equations without additional closure assumptions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0021, THERMOMECHANICAL STRESS ANALYSIS OF ADVANCED TURBINE BLADE COOLING CONFIGURATION

D.J. SHIPPY, Univ. of Kentucky, School of Engineering, *Lexington, Kentucky* 40506 (DF040950; AF-AFOSR-2824-75)

AF function - to contribute to the sum of total knowledge regarding thermal effects for engine components of modern aerospace vehicles. Deficiency - there is a lack of scientific understanding concerning heat transfer for complex and advanced Air Force turbomachinery. Objective -this research effort will attempt to fully evaluate stress distributions for a transpiration-cooled gas turbine engine blade. How work contributes - if more is known about the problem of thermomechanical stresses in the vicinity of a cooling hole for a turbine blade, better Air Force flight systems and components will surely evolve.

Through the use of the boundary integral equation method (BIE), the problem of a thermomechanical stress near a cooling hole in a turbine blade is analyzed. Manufacturing 'realities' of multiple holes, temperature-dependent elasticities, anisotropic effects, viscoelastic effects and the influence of cracks are also considered. The principal investigator will initiate an investigation of orthotropic and anisotropic material modeling for similar classes of thermoelastic problems using the BIE approach.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0022, STRUCTURAL MODEL EVALUATION

W.J. TAYLOR, U.S. Army, Ballistic Research Labs., *Aberdeen Proving Ground, Maryland* 21005 (DA0K4494)

A comparison of good-quality experimental structural response data for large plastic deformations with BRL-developed computer code results. Decide on the most suitable code to use for the analysis of the blast response of helicopters, aircraft and tank bottoms.

Strain and deflection measurements made on structural elements that are shock loaded by air and chemically driven shock tubes will be compared with results produced by codes that are designed to predict such responses. Edge conditions and types of engineering materials will be varied in order to fully exercise the capabilities of the codes selected for evaluation. The program will focus on the ability of the code to perform in the elasto-plastic to fracture stress region.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Ballistic Research Lab.

4.0023, FLUIDIC SEQUENCER FOR SEAT EJECTION

J.M. GOTO, U.S. Army, Harry Diamond Laboratories, *Hyattsville, Maryland* 20783 (DA0F5580)

To assist in the evaluation/demonstration of the feasibility of utilizing fluidics to obtain longer installed life and improved accuracy and reliability in the sequencing of seat ejection systems.

To assist the Naval Ordnance Station personnel by evaluating contractor-designed fluidic circuits, attend contractor program reviews, and help study the feasibility of using a 'continuous sensing' mode for aircrew escape system event sequencing.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Harry Diamond Lab.

4.0024, DETERMINATION OF FLIGHT ENVIRONMENTAL PHENOMENA FOR AVIONICS

J.H. DEJONG, U.S. Navy, Air Test Center, *Patuxent River, Maryland* 20670 (DN031516)

Establish realistic qualification test procedures in specification requirements of airborne electrical and electronic equipment.

Review reports pertinent to the environmental phenomena present in today's aircraft. Determine the areas where additional data are required, and instrument aircraft in conjunction with existing and future projects to obtain the necessary data. Establish realistic laboratory test procedures based on these data and revise the existing environmental specifications where they do not adequately represent the aircraft environment.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Test Center

4.0025, LF/VLF WAVE POLARIZATION

UNKNOWN, Epsilon Laboratories Inc., *Bedford, Massachusetts* (DF901340; F19628-76-C-0181)

AF function - command/control/communications. Deficiency -survivability of long-range emergency communications systems. Objective - to obtain transverse electric and transverse magnetic polarization data of man-made and natural sources. How research contributes -provides information concerning the use of transverse electric waves for improving air-to-air communication range.

Carry instrumented ARCAS rocket payloads to the lower edge of the ionosphere (70 km). During rocket flight, data are telemetered to a ground receiving station.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0026, NETWORK OPERATING SYSTEM STUDY

UNKNOWN, Bolt Beranek & Newman Inc., *Cambridge, Massachusetts* 02138 (DF728240; F30602-76-C-0425)

The objective of this effort is to continue effort begun under contract F30602-75-C-0222 and to examine processor to processor communication and critical functions which are basic to a network operating system.

The contractor will examine the problem using considerable past experience with networking and operating systems and deliver a report detailing findings.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0027, PASSIVE RING RESONATOR LASER GYROSCOPE

S. EZEKIEL, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (DF044120; AF-AFOSR-3042-76)

AF function - navigation, guidance and control of aircraft, spacecraft and missiles require sensors of angular rotation rate in inertial space. Deficiency - the coming use of ringlasers in platform and strapdown systems poses problems of cost, size and reliability. Objective - the intrinsic limitations of the ringlaser are to be avoided by new approaches to angular rate sensing using optical means. How work contributes - the new device should be free from lock-in and bias drift effects usually encountered in conventional laser gyros and should allow size reduction without sacrifice of sensitivity.

Investigation of the limitations of a new laser gyroscope which uses a passive ring resonator as the rotation sensing element and two independently controlled laser frequencies to read out the lengths of the clockwise and counterclockwise paths of the resonator. A sensitivity of one milli-earth-rate is anticapted in an integration time on the order of 100 seconds. Because the laser is outside the ring interferometer solid-state GaAs lasers may be used which would make the gyroscope small in size.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0028, SATELLITE ELECTRON BEAM SYSTEM

W. HUBER, Tri Con Associates Inc., *Cambridge, Massachusetts* (DF243520; F19628-75-C-0114)

AF function - operational satellites. Deficiency - electrical charging of satellites may cause interruption or failure of electronic components of the satellite. How research contributes - development and flight of an electron beam system to induce controlled electrical charging. By simulating satellite charging the effects on a satellite of being charged while in orbit can be determined. The extent and nature of deleterious effects on electronic equipment can be studied.

A system will be built to enable the controlled ejection of high energy electrons from a satellite. An electron beam successfully used on a number of rocket experiments will be the source of the electrons. The current, energy, and duty cycle of the ejected electron beam will be variable, and will be controlled by ground commands. The beam current will be variable from 100 nanoamperes to a milliampere, the range of energies will extend from .5 to 3 keV and the duty cycle extend from .01 percent to continuous. The specifications now call for the entire system, exclusive of batteries to weight 5 pounds, to be contained in a volume of less than 200 cubic inches, to operate from batteries supplying from 20 to 40 volts, and to use less than 15 watts at maximum beam power.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

4.0029, LASER-INDUCED DAMAGE AND MECHANICAL PROPERTY CHANGES RESULTING FROM LASER IRRADIATION

L.A. SHEPARD, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0F4749)

The objective of this program will be to ascertain the nature and extent of micro-structural changes produced by laser irradiation of materials commonly used in Army helicopter components. These changes will be assessed metallographically and their effect on fatigue life and stress-corrosion cracking will be determined. Methods for deterring microstructural transformation of the surface, such as by diffused surface layers, will be evaluated.

Specimens of low-alloy structural steels, titanium alloys, and high-strength aluminum alloys, typical of a variety of helicoptor

components (e.g., the rotor hub assembly in the case of the steel or titanium alloy) will be exposed to increasing levels of laser radiation to determine the time/intensity threshold for the inception of surface damage. Specimens will be tested in low-cycle fatigue under ambient conditions and also in an environment of a 3 1/2 percent solution of NaCl. The steel specimens will also be fatigue tested in a distilled water environment. Standardized stress-corrosion tests will be performed as well. Particular attention will be paid to the possibility that materials, normally susceptible to stress-corrosion only in the precracked condition, may have been rendered susceptible due to laser damage. Specimens will be subjected to a variety of diffusion treatments in which the surface composition will be altered in a manner designed to deter surface transformation. Elements such as chromium and silicon will be diffused into the surface prior to exposure to the laser, and the specimens will then be tested as before.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Materials & Mechanics Research Center

4.0030, ELECTROMAGNETIC SCATTERING
T.B. SENIOR, Univ. of Michigan, School of Engineering, *Ann Arbor, Michigan* 48106 (DF047000; AF-AFOSR-3188-77)

AF function - radar scattering cross-section reduction for aerospace vehicles. Opportunity - radar absorbing surface coatings reduce cross section. Objective - to reduce not only specular but also nonspecular or diffracted contributions to scattering cross section. How work contributes - by examining the effect that surface coating impedance has on travelling, creeping, and edge waves, edge reflections, etc.

Three research areas seem promising. First, numerical algorithms for cross-section reduction for an edged finite body are now limited to low frequencies. More economical higher frequency schemes will be sought. Second, analytic solutions to half planes with layered anisotropic impedance coatings and obliquely incident radiation will be sought through an extension of Hurd's Wiener Hopf technique. Such solutions may serve as canonical local solutions or finite elements for more general approaches. Third, studies of low-frequency scattering by absorber-coated structures will use the polarization tensor approach.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0031, RADIATION IN MOS/SOS DEVICES
A.K. KOKKAS, Radio Corporation of America, *Princeton, New Jersey* 08540 (DF900310; F19628-76-C-0183)

AF function - weapons delivery. Deficiency or opportunity - current nuclear hardness requirements for semiconductor devices are not being met. Objective - to investigate the effect of processing variables such as oxidation, diffusion, ion implantation, and silicon growth on the radiation characteristics of the silicon sapphire interface. How research contributes - this research will contribute to the development of a radiation hardened CMOS/SOS technology. The results of the process parameter investigation will contribute significantly to optimizing the radiation hardness of silicon on sapphire for use in Air Force space and missile systems.

Special test devices will be fabricated to evaluate the silicon sapphire interface. These will include MIS capacitors using the sapphire substrate as the gate dielectric, JFET's, and MOSGET's. Variations in device process parameters including silicon growth conditions will be correlated with the radiation response of the silicon sapphire interface.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0032, ENGINEERING AND INSTRUMENTATION SUPPORT FOR ROCKET AND BALLOON LAUNCH OPERATION
R.A. BUMGARNER, New Mexico State University, School of Arts & Sciences, *Las Cruces, New Mexico* 88001 (DF247520; F19628-76-C-0171)

AF function - command, control and communications. Deficiency -reduced effectiveness for supporting research rocket firings at WSMR and research balloon launches at Holloman AFB. Objective - to provide effective engineering and instrumentation support during the launching of scientific rocket and balloon payloads at WSMR and Holloman AFB. How research contributes - the instrumentation systems developed allow the aerospace investigations to be conducted on a timely and cost-effective basis. Projects depending on this research include 1366, 6687, 6688, 6690, 7659, and 7670.

The technical approach includes integrating range safety, tracking and recovery systems into rocket payloads to be launched in support of various scientific programs. A telemetry facility will be maintained and operated to provide for the prelaunch testing of the instrumented research rockets to be launched at WSMR. Approach also provides for equipment calibration and data analysis during balloon launches at Holloman AFB, New Mexico. Coordination will be provided between the instrumentation engineers and the launch sites to satisfy documentation or other technical interface requirements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

4.0033, ANALYTICAL TRANSONIC FLOW
L. SIROVICH, Applied Science Research Assn., *New York, New York* 10023 (DN623024; N00014-77-C-0359)

The determination of theoretical methods for the accurate prediction of the flows about high-speed bodies is essential for the design of missiles and aircraft. This research is directed to the development of a very fundamental understanding of the steady and unsteady flow fields about bodies at transonic and supersonic flight.

A major effort is being directed to the analytical study of transonic and supersonic flows to complement the many ongoing numerical and experimental programs. Particular emphasis will be devoted to the study of the structure of the flow field within the framework of the Navier-Stokes equations and within the framework of higher order approximate equations, both viscous and inviscid. The direction of the research will be to exploit analysis as much as possible to develop a deeper understanding of the flow, as well as to leading to improved numerical procedures for attacking such flows.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0034, STUDY CHARACTERISTICS OF SONIC BOOMS AND STRATOSPHERIC WINDS
UNKNOWN, Columbia University, Graduate School, *New York, New York* 10027 (FA77WA-3997; FA160341 (TRAIS NO.))

Conduct a study of the characteristics of sonic booms and stratospheric winds. The work shall include the following: 1. Sonic Booms on Long Island. (a) Calibrated instruments shall be installed at two locations; toward the north shore to provide information on the strength of the signal at the closet point to the flight path to detect the decay of the signal with distance. 2. Stratospheric Winds. (a) Determine the feasibility of using long-range sound from the Concorde of the analysis of data from the tripartite array of detectors and from this single station, determine whether additional stations properly placed can give more precise information on stratospheric winds.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

4.0035, QUASI-ORDERED STRUCTURES IN FREE TURBULENT SHEAR FLOWS
R. LAURINVAGLIO, New York University, Graduate School, *New York, New York* 10003 (DF049650; F49620-77-C-0119)

AF function - aerospace vehicles. Opportunity - quasi-ordered structures are known to exist in turbulent shear flows. However, the sequence of the breakdown and position of the energy hierarchy from mean flow to the smallest eddies is only quantitatively understood. In the light of recent data, there is a possibility of quantitatively understanding and describing the nature, scale,

interactions and attendant energy balances for the ordered structures that produce and maintain the turbulent character of the flow. Objective - to develop an analytical model for turbulent free shear flows from a wave mechanics viewpoint that recognizes (a) the development of ordered structures, (b) the interaction among, and the agglomeration of, these structures, (c) the initiation of the turbulent energy cascade and the energy partition within them. How work contributes - if the objective of this effort is successful, the basis for the computation of turbulent flows will be on a firmer physical footing. It will also elucidate the mechanisms for producing and partitioning the turbulent kinetic energy. The predictive capabilities for advanced aerospace vehicles will be greatly enhanced by the new insights and quantitative evaluation available from models of this type.

The work will be an analytical effort to evolve the phenomenological description of the interactive mechanisms of the quasi-ordered structures developed in a turbulent shear flow. The first description will concentrate on the two-dimensional free shear layer. Close coordination with parallel experimental programs will be maintained.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0036, NONLINEAR CIRCUIT SYNTHESIS TECHNIQUES

D.E. WARREN, U.S. Air Force, Rome Air Development Ctr., *Rome, New York* 13440 (DF736560)

The objective of this effort is to develop design procedures to minimize nonlinear effects in mildly nonlinear circuits. Specifically, design procedures that will reduce nonlinear distortions such as intermodulation, desensitization, gain compression, etc., in amplifier circuits will be explored.

The approach to be used is one that relies on reducing in-band nonlinear distortion products by modifying the first-order transfer functions outside the band of interest. The technique to be used makes use of the fact that certain high-order nonlinear effects in the passband are functions of first-order network parameters at frequencies outside the band, by appropriate modification of these first-order parameters in-band nonlinear effects can be reduced.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0037, DETERMINATION OF CAVITY FIELDS EXCITED BY AN ELECTROMAGNETIC PULSE THROUGH AN APERTURE

D.K. CHENG, Syracuse University, School of Engineering, *Syracuse, New York* 13210 (DF043650; AF-AFOSR-3002-76)

AF function - the penetration problem of nuclear electromagnetic (EMP) energy into the interior of a cavity-like structure through an opening in the surface is of particular practical importance to the Air Force EMP assessment, testing and hardening programs for aircraft systems. Deficiency - considerable effort has been devoted to the investigation of electromagnetic coupling through cavity-backed apertures of various shapes and sizes. However, small apertures are usually assumed and the effect of cavity reflections on aperture field distribution is usually neglected. Objective - to develop suitable numerical solution procedures for cavity backed aperture problems avoiding the quasi-static approximation and treating the internal and external portions of the problem simultaneously. Contribution - work will provide improved computational ability for aircraft assessment programs as well as representative calculations of the field at typical points inside a rectangular cavity when a transient electromagnetic plane wave is incident upon a slot aperture.

In previous work, the quasi-static approximation was avoided and the internal and external portions of the problem were solved simultaneously. The induction theorem was invoked in determining the scattered fields. New variables were introduced to change the governing second-order differential equation to a set of first order equations which correspond to normalized state equations. The method of moments was used to convert the LaPlace-transformed differential equations into a set of matrix equations. The primary goal of the current work will be to develop suitable numerical solution procedures for the matrix equations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0038, IN-HOUSE OPTICAL MUX PROGRAM

E.N. HUMPHREYS, U.S. Air Force, Avionics Laboratory, *Dayton, Ohio* 45433 (DF094640)

To supply the Air Force with information and data on fiber optic data transfer components and subsystems and to provide an in-house capability to analyze, test, and verify the feasibility of selected aspects of optoelectronic technology.

A selected range of internal data transfer requirements for aerospace vehicles will be addressed under this effort. This includes: (1) multiplexed fiber optic data buses, (2) multiplexed fiber optic point-to-point systems and (3) dedicated point-to-point (both analog and digital) fiber optic systems. This effort will (a) design, fabricate and test electrooptical data transfer links, (b) develop and test various approaches to fiber optic terminations, handling and repair, (c) investigate input/output devices for the electrooptical data links in order to achieve system optimization, (d) develop dynamic analyzer test programs for testing optical and electrooptical components and systems in a simulated operational environment and (e) evaluate components, model and validate systems, and test and evaluate prototypes to provide a data base for system component selections for future aerospace vehicles. An in-house lab will be established to measure and test components and subsystems. New data will be gathered and data from other sources will be verified. By gaining expertise in the area, recommendations can be made to branch and division on use of fiber optics technology in other system development programs. The lab will be capable of measuring light sources, photo detectors and optical fibers, both as components and in systems. Data signals will be analyzed before transmission over a fiber optic link and then afterwards to evaluate bit error rate for various configurations. Other tests will be performed to establish lifetime of components, survivability of components and systems subjected to vibration and temperature extremes and the reliability of systems that have been assembled from component parts.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0039, THEORY AND COMPUTER CODES FOR NON-EQUILIBRIUM PLASMAS

M. STAMM, U.S. Air Force, Aeropropulsion Laboratory, *Dayton, Ohio* 45433 (DF458820)

AF function - power, weaponry, communication, tracking and navigation. Deficiency - lack of knowledge of plasma interaction processes in MHD generators, gas discharges and lasers. Research -theoretical description of interaction processes in non-equilibrium plasmas. How research contributes - improved power systems, enhanced laser performance (quality, power, stability, lifetime). Valuable information on sheath development, pumping rates, laser gain, and plasma stability will be made accessible in terms of experimentally variable quantities.

Three different, yet coupled, aspects of non-equilibrium plasmas control their operation and govern their performance characteristics: (1) the electron energy distribution, (2) molecular kinetics, (3) plasma chemistry. A self-consistent theoretical investigation of plasma interaction processes is undertaken. The collisional Bottzmann equation is numerically solved to yield the electron energy distribution as a function of electric field, neutral number density, electron density, and species concentration. Molecular kinetics and plasma chemistry are consistently coupled into the calculation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aeropropulsion Lab.

4.0040, AVIONICS EVALUATION PROGRAM

D.E. SUMMERS, U.S. Air Force, Avionics Laboratory, *Dayton, Ohio* 45433 (DF098030)

Perform in-house analyses of air-to-ground weapon system concepts utilizing a computerized model. The analyses quantitatively assess the impact of avionic reliability, subsystem performance and system survivability on mission effectiveness. Sensitivity and trade-off analyses performed under this effort will pro-

vide performance data to engineers involved in concept synthesis and analysis.

Utilize the avionics evaluation program (AEP) to perform trade-off and sensitivity analyses. The AEP is an air-to-ground mission effectiveness model which has been implemented in a conversational interactive graphics mode. Data generated using the AEP include: number of targets killed, targets acquired, a/c lost and mission aborts, avionic utilization data, avionic black box failures, subsystem performance data and weapon delivery error sensitivities.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0041, LOW-G LAUNCHING SYSTEM

W.E. PETRANSKY, Gulf & Western Ind. Prod. Co., *Swarthmore, Pennsylvania* 19081 (DF320530; F33615-75-C-0121)

To provide a reproducible method for obtaining a controlled velocity within plus or minus 3 percent for simulating crash environments based on the deceleration of test subjects and fixtures rather than the acceleration of subjects and fixtures.

A stored energy launching system will be developed, designed, built and tested by the contractor. This system will impart to the existing AMRL impact sled the required velocity using the existing track system. The device will provide a minimum of one second unpowered coast time prior to impacting a braking device at a maximum velocity of 125 feet per second. The minimum required impact velocity will be 10 feet per second.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

4.0042, RESEARCH IN GAS LASERS

T.F. MORSE, Brown University, Graduate School, *Providence, Rhode Island* 02912 (DF038310; AF-AFOSR-2645-74)

AF function - weaponry. Opportunity - kinetic theory and fluid mechanical knowledge are continuing to improve the basic understanding of gas lasers. This principal investigator distinguished himself during the former AFOSR rarefied gas dynamics program, and under the present grant he has made significant contributions to the technical literature of gas laser kinetics. Several aspects of the fluid mechanics and kinetics of gas lasers still require clarification to facilitate improved design capabilities. Objective - to extend classical kinetic equations, developed previously, to include nonlinear radiative effects, and to seek experimental verification of some of the theoretical results. How work contributes - this work will permit the treatment of the interaction of two radiation fields with three-level atom which has important applications in nonlinear saturation spectroscopy and the study of many details of processes occurring in molecular gas flow lasers.

Theoretical work will involve pulse propagation and time-dependent effects in saturation spectroscopy. Collisional effects, inhomogeneous broadening, rotational and vibrational relaxation, as well as nonlinear effects associated with the presence of more than one field will be considered for line-dependent problems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0043, HIGH-ALTITUDE TETHERED BALLOON DESIGN AND FABRICATION

J.D. BEEMER, Raven Industries Incorporated, *Sioux Falls, South Dakota* 57101 (DF246430; F19628-76-C-0149)

AF function - advanced high-altitude tethered balloon system for surveillance, monitoring, environmental research, and space vehicle test. Deficiency - current tethered balloon technology and equipment limits the use of this type of vehicle to altitudes less than 10km. Objective - design and fabricate a balloon capable of being raised to and tethered at an altitude of 20 km. How research contributes -development and flight at 20 km will prove the feasibility of operating tethered balloons under these conditions on an operational basis.

The design of a balloon capable of carrying a 200 lb payload and over 1600 lbs of tether cable to 20 km will be undertaken. Simplicity of the design for allowance of a 10-fold gas expansion from the ground to altitude, reliability of balloon control techniques, and economy will be prime characteristics sought in the design stages. Fabrication of one or two free-flight models will allow evaluation of the approved design and modifications before the final balloon is constructed. This final balloon will then be tested as a tethered system.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

4.0044, EVALUATION OF A FLUIDIC OXYGEN SENSOR

R.L. WOODS, Univ. of Texas, School of Engineering, *Arlington, Texas* 76019 (DF319960; F41609-76-C-0028)

The contractor will verify the fluidic concentration sensing concept using the sensor constructed by USA Harry Diamond Laboratories for USAFSAM. The sensor's operational characteristics, environmental sensitivities, and operational support requirements will be quantitatively evaluated. Subsequently an assessment of the sensor's potential integration into a feedback-control oxygen delivery system will be performed. This effort is part of a line of endeavors to develop oxygen delivery control devices which will result in improved aircrew safety, yet optimize oxygen usage, maintenance, and reliability.

Using the existing sensor as a starting point the contractor will fabricate or provide additional hardware elements for fluidic interfacing. Initial evaluation will concern experimental assessment of the sensor's inherent accuracy during exposure to simulated aerospace environments. In particular the interfering effects of carbon dioxide and water vapor in sample and reference gases will be detailed. Satisfactory findings for sensor accuracy, as assessed by a USAFSAM review panel, will be followed by design and implementation of fluidic amplifiers and ancillary components for purposes of boosting sensor output signals to control compatible levels. A final technical report will explicitly enumerate the sensor concept's potential for utilization with on-board oxygen delivery schemes. ASD requirements for this effort are documented in ASD/SM letter of 31 Mar 75. To assure appropriate integration of biomedical and engineering considerations, the progress, data, and reports on this effort are jointly monitored by AFFDL.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

4.0045, BASIC RESEARCH IN ELECTRONICS (JSEP)

E.J. POWERS, Univ. of Texas, School of Engineering, *Austin, Texas* 78712 (DF015240; F49620-77-C-0101)

AF function - electronic research is essential to all Air Force missions and functions, especially aerospace reconnaissance, communications, surveillance, navigation, command and control of operating forces, and gathering, processing, and transmission of intelligence and information. Technology for all of these functions requires lower cost, more compact, lower power consumption, higher sensitivity and more reliable electronic components, networks and systems. Opportunity-continued research on properties of electronic materials, circuits, and systems supports this technology. Objective -the Joint Services Electronics Program (JSEP) provides the research baseline in the electronic sciences for all three military services. How work contributes - jointly and equally supported and managed by the Air Force, Army and Navy, it provides the DOD with a hard core electronic research capability which includes a highly flexible, quick response to new research opportunities over a broad area of electronic science and engineering.

This JSEP effort addresses itself to theoretical and experimental research in solid-state materials and devices, electronic digital computers and systems, electronic control systems, electronic and optical pattern recognition, quantum electronics, holography and optical systems, plasma electronics and atomic and molecular electronic processes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0046, A MICROPROCESSOR IMPLEMENTATION OF A NAVIGATION POSITIONING ALGORITHM FOR THE LOW-COST GPS RECEIVER

P.S. NOE, Texas A & M University System, School of Engineering, *College Station, Texas* 77843 (DF049250; AF-AFOSR-3377-77)

AF function - design of microprocessor algorithms. Deficiency -accurately timed signals, received from several orbital satellites for navigation purposes, are corrupted by various electronic noise sources, and require filtering to properly process them. Objective - it is the objective of this research program to develop a microprocessor implementation of an algorithm devised by the principal investigator (PI) under a USAF/ASEE summer faculty fellowship. How work contributes -if successful, this program would present a viable candidate for a low-cost on-board navigational receiver for casual installation in diverse aerospace vehicles.

A low-cost navigation positioning algorithm was previously developed by the proposed PI under Air Force support. This research will utilize IBM high-level language programs to optimize the machine code for microcomputer application. Subsequently, the microbe will be implemented to demonstrate the effectiveness of microcomputer hardware as a feasible component of the GPS system.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0047, SOLID-STATE TRACE CONTAMINANT GAS ANALYZER FOR AIRCREW ENVIRONMENTS

R.E. DESSY, Virginia Poly. Inst. & St. U., School of Arts & Sciences, *Blacksburg, Virginia* 24061 (DF319240; F41609-75-C-0004)

To design and fabricate a solid-state semiconductor handheld gas analyzer applicable to field assessment of trace contaminants in aircrew environments. Present indications are that the semiconductors to be utilized in this gas analyzer are rugged enough not only for field use but also in-flight use. A specific application of an instrument or system of this type is the USAF ATC requirement to test ambient aircraft cockpit atmospheres for the presence of oil vapors and other contaminants.

The approach for the design and fabrication of a prototype instrument of this type will be to modify the semiconductor surface. This will be done by ion-implantation, ion-etching, and/or coating techniques. These techniques, singularly or in combination, will render the device active and specific to given structural families of contaminants, i.e., CO, NOX, hydrocarbons, aromatics and polar compounds. The response of the modified semiconductor will be directed to a microprocessor for analysis and the readout will be accomplished by a strip printer.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

4.0048, REFRACTING GAS PRISM AND AERODYNAMICS OF ELECTRON BEAM DISCHARGES

W.H. CHRISTIANSEN, Univ. of Washington, School of Engineering, *Seattle, Washington* 98105 (DF026720; AF-AFOSR-2650-74)

AF function - weaponry. Opportunity - some fluid mechanical flows have promise for performing as optical elements for handling the light output of high-power lasers at power densities higher than those possible with solid-state mirrors, lenses, prisms, and windows. Objective - to both theoretically and experimentally study aspects of fluid mechanical optics that might lead to new optical systems useful for laser technology. The fluid mechanical optics program has been expanded to include more than the light capacitor (which is the primary object of the present work) since this program is fundamentally an investigation of all the aspects of fluid mechanics and their application to optics. How work contributes - the small losses associated with refraction of light in gases suggest the possibility of efficiently manipulating laser beams by gaseous media of continuously varying refractive index. The proposed research provides insight into basic mechanisms of gas prisms which could be used to either deflect very intense laser beams, as a light storage device or delay unit, or as a tool which could be useful in the study of very low gain gaseous laser media.

Experiments will continue with the 90 degree Venus machine to determine the effect of nozzle segment misalignment and to determine the shape of the light well. The experiments will be extended to power levels in the megawatt range. Experiments with the 360 degree machine will attempt to show the feasibility of trapping light in a full circular path. The aerodynamics of electron beam sustained discharges in a supersonic flow will also be studied.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, MAGNETOSPHERE IONOSPHERE COUPLING PROCESSES

J.R. KAN, Univ. of Alaska, School of Arts & Letters, *Fairbanks, Alaska* 99701 (DF248290; F19628-77-C-0038)

AF function - communication, navigation, ionosphere and magnetosphere modelling. Deficiency - inadequate knowledge of the magnetospheric processes driving aurora to meet AF needs. Objective - to determine theoretically the fraction of earthward plasma flow that is of polar wind origin and assess its role in ionosphere-magnetosphere coupling processes. Investigate factors which lead to breakdown of perfect mapping of electric fields in the ionosphere. How research contributes - provides information essential for design and utilization of communications, guidance and surveillance systems, provides understanding of magnetosphere-ionosphere coupling processes.

Study theoretical relationship between polar wind and auroral ionosphere perturbations, study electric field mapping techniques between ionosphere and magnetosphere in presence of field aligned electric fields.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0002, APPLICATION OF REMOTE SENSING TO THE DEVELOPMENT OF REGULATIONS GOVERNING OFF-ROAD VEHICLE USE ALONG THE TRANS-ALASKA PIPELINE

J.D. MCKENDRICK, Univ. of Alaska, Sch. of Land Res. Mgmt. & Agri, *Fairbanks, Alaska* 99701

STATEWIDE -- Trans-Alaska Pipeline corridor. To locate sites along the pipeline which are particularly sensitive to off-road traffic; to use remote sensing satellite imagery for vegetation mapping.

SUPPORTED BY U.S. Dept. of the Interior, Bureau of Land Management

5.0003, A MODULATED DOPPLER LIDAR FOR WIND MEASUREMENT 13343-GS

R.M. SCHOTLAND, Univ. of Arizona, School of Liberal Arts, *Tucson, Arizona* 85721 (DA0X5573; DAAG29 76 G0115)

To develop, using a modulated beam, a Doppler lidar for wind measurement which will substantially increase range over other systems through reduction of distortion factors. Capability for remote sensing of atmospheric motions has relevance to a number of military systems, particularly to artillery and free-flight rocket technology. There also is relevance to Army aviation applications.

Studies will include theoretical analysis of signal-to-noise properties of modulated lidar systems, design and construction of a lidar wind measurement system including data handling procedures, and finally, testing of the system in the laboratory and at calibrated field site.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Army Research Office

5.0004, COMMUNICATIONS - MAGNETOSPHERIC SUBSTORMS

R.L. MCPHERRON, Univ. of California, School of Letters & Science, *Los Angeles, California* 90024 (DN023137; N00014-75-C-0396)

The ionospheric disturbances associated with geomagnetic storms degrade or disrupt naval communications, navigation, and surveillance systems. An understanding of the triggering mechanism, evolution, location, extent and magnitude of geomagnetic storms can lead to the ability to predict the occurrence of magnetic storms and their effect on naval electromagnetic systems.

Ground and satellite magnetometer data is used to monitor electric currents in the magnetosphere and ionosphere during magnetic substorms. Studies of the parameters characterizing substorm currents and of the microstructure of substorms will be performed. Real time monitoring of substorm disturbances will be initiated. The formation of partial ring currents and its relationship to solar wind parameters and the role of magnetic micropulsations in triggering the expansion phase of substorms will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0005, ENVIRONMENTAL REMOTE SENSING

V. NOBLE, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN220082)

To determine experimentally the necessary remote sensors and techniques which are applicable for improving oceanographic monitoring and prediction. Coordinate remote sensing studies with the objective of satisying Navy Environmental Remote Sensing Program (NERSP) needs.

Utilize electromagnetic sensors, both passive and active, to Determine quantitatively the accuracies with which sea surface temperature, surface winds, wave heights, topography and other sea surface parameters can be measured to insure that the measurements and techniques are fulfilling NERSP's needs.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

5.0006, NAVY ENVIRONMENT - MESOSCALE STORM ACTIVITY

H. HISER, Univ. of Miami, School of Engin. & Env. Design, *Miami, Florida* 33124 (DN624020; N00014-75-C-0172)

In the interest of improving the meteorological forecast for the mesoscale range of convective storm activity, the objective of this research is to discover and understand the interplay of local and meteorological factors controlling the area-wide storm activity. By mesoscale range is meant an area of one to two hundred kilometers on a side as for, say, an amphibious or coastal operation.

Using an extensive complex of meteorological data for a triangular area located between the angle apices at Tampa, Miami, and the Kennedy Space Center, the flux of moisture through the walls of the triangle will be computed and compared with a variety of other data including that of sferics, radar, satellite (both visual and infrared cloud imagery) and raingauge and evapotranspiration.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0007, MEASUREMENT OF THE NEAR-UV SOLAR FLUX

D.E. BEDO, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF254650)

AF function - vehicle tracking during flight and reentry, trajectory prediction, communication systems. Deficiency - insufficient data to allow accurate modelling of the average composition and structure of the upper atmosphere and of the ionosphere and to predict properly the response of the atmosphere and ionosphere to temperal variations in the solar input. Objective - the precise measurement of the incident solar intensity throughout the spectral range 50 to 3000 Angstroms under differing levels of solar activity and the derivation, from observations of atmospheric absorption at wavelengths within this spectral range, of the composition of the atmosphere above 100 kilometers. How research contributes - provides direct measurement of the major source of energy which is input to the upper atmosphere and the manner of deposition of this energy as a function of altitude--explicit considerations in models of atmospheric heating, photochemical equilibrium and charged particle production.

Solar intensity data are acquired from rocket-borne instrumentation. For the short wavelength region, 50 to 1250 Angstroms, scanning spectrometers of the grazing incidence type are used while at longer wavelengths, 1250 to 3500 Angstroms, the spectrometers are of the normal-incidence, Ebert type. Intensity data are obtained at rocket altitudes above 100 km on both the up-leg and down-leg portions of the trajectory. At apogee, the measurement is essentially the unattenuated flux, requiring only a minor correction for the remaining atmospheric absorption. For wavelengths shorter than 1000 Angstroms, appreciable absorption is observed at the lower altitudes permitting a determination of the optical depth as a function of altitude. From model considerations and measured optical depths, the number density of the atmospheric components can be inferred. Prior to launch, flight instrumentation is calibrated at AFCRL using laboratory monochromators and photometric standards.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0008, HF PROPAGATION AT HIGH LATITUDES

J. BUCHAU, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF244700)

AF function - communications via and through arctic and other disturbed ionospheres and OTH radar. Deficiency - incomplete understanding of disturbed ionosphere and its effects on communications, navigation and OTH radar. Research - arctic propagation experiments conducted by airborne ionospheric laboratory and the Goose Bay Ionospheric Observatory (GO). Study effects of the ionosphere on radiowave propagation in terms of auroral absorption, mode availability, Doppler spread. Development of gioreal-time ionospheric specification. Improved understanding of gradients, irregularities and rapidly varying and disturbed ionospheric conditions on EM propagation. How research contributes - aids the development of OTH radar systems such as 414L 440L, survivable communications systems, and satellite systems such as AFSATCOM, GPS and DSCS in terms of improved design, and operations. Improvements are in the areas of bandwidth, power requirements, frequency management, antenna design, system accuracy and reliability assessment and operational employment procedures.

This work unit makes use of the Airborne Ionospheric Laboratory and the Goose Bay Ionospheric Observatory to study the effects of the strong ionospheric gradients occurring at high latitudes and the associated auroral activity on HF propagation, especially with OTH problems in mind. Propagation flights in the 414L coverage area will be made starting in January 1976 in conjunction with new antennas at Goose Bay and RADC to study specific aspects of the 414L situation. These tests will allow to further evaluation of the ionospheric model to be used during the 414L test phase. A report on past oblique HF propagation experiments will be completed by january 1976. The aircraft will be equipped to play a vital role in the 414L performance tests. Airborne UHF scintillation studies will be continued in connection with AFSATCOM I and II in the arctic and equatorial anomaly regions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0009, CRUSTAL TILT FIELDS

G.H. CABANISS, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF249170)

AF function - strategic weapons delivery. Objective - temporal and spatial characteristics of small earth crustal motions will be determined with a variety of techniques. Theories or methods will be developed to predict these variations over practical times and distances. How research contributes - this work pertains to the testing and operational deployment of the Minuteman and

MX weapons systems and other inertial and communication systems in an earth noise environment.

Crustal tilts are monitored by two borehole tiltmeter arrays of different design. These will be compared at various frequencies with each other and with theory. This capability should be further enhanced with the expected availability of satellite altimetry of the North Atlantic and later by the SEASAT program to better define the loads from ocean tides.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0010, AIR-LAUNCHED BALLOON TECHNIQUES
A.S. CARTEN, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF240270)

AF function - advanced balloon systems (surveillance, reconnaissance, communications, environmental research support). Deficiency or opportunity - present vehicles have limited altitude and payload capabilities. Objective - to develop an all-weather operational lighter-than-air (LTA) vehicle or platform to put high-altitude sensors and communications relays on station quickly and on short notice over battle theaters. How research contributes - this work involves in-house studies and investigations leading to the design, fabrication and test of a prototype aircraft-launched high-altitude balloon system. When the goals of this research are achieved it will be possible for the Air Force to deploy and inflate in mid-air, automatically and quickly, LTA platforms capable of supporting payloads weighing up to 1000 lb for 24 hours at altitudes of 80,000 ft or better. This capability will enhance the effectiveness of Air Force missions whose mode of operation requires the rapid availability of low-cost substitute satellite systems, such as the TRI-TAC multi-mode transmission system (478T).

The developmental concepts for a large air-launched balloon system have been outlined previously under this work unit and were reported in AFCRL-TR 73-0633. Certain technical problems were identified, whose solution is essential, such as designing the cryogenic storage system for maximum efficiency and safety, choosing the most effective and desirable method of vaporizing the cryogen and warming the gas quickly to ambient temperatures, determining optimum balloon materials and balloon deployment procedures, and sizing system decelerators. The approach is to attack these problems through in-house studies and laboratory experiments in an attempt to resolve all present design uncertainties. Cryogenic and heat transfer experimental work will be performed by the National Bureau of Standards, Cryogenics Division. When the desired data are obtained, a prototype system design will be completed and one or two units will be fabricated under contract. It is planned that the prototypes will be air-launched initially at Holloman AFB in 1976, prior to scheduled air launch tests near the TRI-TAC test bed at Fort Huachuca, Arizona, in July 1977. The latter tests are designed to compare the performance of LTA platforms with that of remotely-piloted vehicles.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0011, AIR-LAUNCHED BALLOON TECHNIQUES FOR TACTICAL COMMUNICATIONS
A.S. CARTEN, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF247560)

AF function - advanced balloon systems (surveillance, reconnaissance, communications, environmental research support). Deficiency or opportunity - present vehicles have limited altitude and payload capabilities. Objective - to develop an all-weather, operational lighter-than-air (LTA) vehicle or platform to put high-altitude sensors and communications relays on station quickly and on short notice over battle theaters. How research contributes - this work involves key experimental investigations connected with the design, fabrication and flight test of the prototype of a novel, cryogenic-inflation gas-storage and heat-transfer device. The need for a breakthrough in this technical area has been identified as essential to the successful development of an air-launched balloon system (ALBS) for tactical communications. This research is intended to firm up the concept of a cryogenically-based ALBS and to permit the dimensions and expected performance criteria of such a system to be established. If successful, this research will open the way to development of air-launched LTA platforms capable of supporting payloads weighing up to 1000 lb for 24 hours at altitudes of 80,000 ft or better. Such a capability will enhance the effectiveness of Air Force missions whose mode of operation requires the rapid availability of low-cost substitute satellite systems, such as identified in TAC TOC 305-75.

The developmental concepts for a large air-launched balloon system were reported in AFCRL-TR-73-0633. An urgent technical problem identified in the report was the need for a cryogenic storage subsystem to vaporize liquid helium and warm the gas quickly to ambient temperatures. Substantial experimental assistance along this line was obtained in FY75 and in early FY76 from the National Bureau of Standards, Cryogenics Division, under project orders Y75-808 and Y76-800. A highly successful test followed in Nov 75 at Holloman AFB, when a full-size balloon was inflated from a heavy ground-based cryogenic system and flown with a payload of several hundred pounds, to the operational altitude required for an LTA relay platform. Although this was an important milestone, it did not address the need for the design and fabrication of flight-weight cryogenic hardware for advanced tests involving mid-air launches. (Text abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0012, SATELLITE MEASUREMENTS OF SOLAR UV
H.E. HINTEREGGER, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF244000)

AF function - vehicle tracking during flight and re-entry, trajectory prediction, communication systems. Deficiency - insufficient data to allow accurate modelling of the average composition and structure of the upper atmosphere and of the ionosphere, and to predict the response of the atmosphere and ionosphere to temporal variations in the solar input. Objective - determine the importance of the solar radiation within the spectral range from 140 to 1850 Angstroms in maintaining the composition and thermal structure of the upper atmosphere. Develop a set of indices characterizing the temporal variation of this solar radiation, which is the putative cause of the variations in the atmospheric composition, density and thermal structure. How research contributes - measurements of this solar radiation are made eleven times a day, at various latitudes, longitudes and solar zenith angles. The measurements are continued through many solar rotations, and are to be examined in correlative studies with other observed effects. Atmospheric composition, density and temperature are measured by analysis of the attenuation profiles of selected solar emission lines during perigee passes and at sunrise and sunset.

Specially designed grazing incidence spectrometers are mounted on a solar oriented platform on the NASA Atmosphere Explorer series of satellites. These instruments cover the spectral range from 140 to 1850 Angstroms, and each is made up of 24 individual spectrometers, multiplexed onto 12 detectors. The satellite contains an apogee motor, so that perigee passes down to 120 km can be maintained by an occasional apogee burn. The low perigee allows the study of attenuation of the solar radiation in certain emission lines, from which composition, density and temperature of the upper atmosphere may be derived. Above the attenuation region, but below the energetic particle belts, unattenuated incident solar flux data is required (11 measurements per day). During sunrise and sunset at the satellite, the occultation of the sun by the upper atmosphere allows analysis of the atmosphere remote from and below the satellite orbit. Some of the spectrometers which take data in spectral regions absorbed at very low altitudes in the atmosphere have been especially designed to optimize this sunrise-sunset opportunity. Three separate orbit orientations are planned. (Text abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0013, AURORAL AND AIRGLOW BACKGROUND STUDIES
R.M. NADILE, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF580360)

AF function - atmospheric infrared backgrounds. Deficiency - lack of knowledge of infrared properties of the atmosphere. Objective -develop an auroral and airglow background emission model based on visible and infrared field measurements. How research contributes -accurate modeling of auroral and airglow emissions will provide a background predictive capability which can be used to evaluate future af surveillance system designs.

An infrared auroral and airglow background predictive capability will be developed for selected spectral regions of interest to Air Force surveillance missions. This capability will be achieved through an analysis of an existing infrared data base, its comparison with simultaneous visible measurements, and their incorporation into a theoretical model.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0014, FINE-MESH LIMITED-AREA MODELS
R. SHAPIRO, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF249320)

AF function - military operations involving Air Force vehicles used by strategic, tactical and general-purpose forces. Deficiency - such operations are adversely affected by deficiencies in specifying and predicting winds and weather on time and space scales which are smaller than the typical meteorological observational network. Objective - to enhance the detail of numerical weather prediction. How research contributes - research will improve forecasts on fine-mesh networks over any specific limited area of the earth.

The approach is to carry out numerical solutions of primitive equation mathematical models of the atmosphere over limited areas of the earth. Artificial lateral boundary conditions, which must be specified because of the limited area, tend to produce computational instability and degeneracy in the forecasts. High ordered interpolation and filtering procedures will be investigated as a means of suppressing the lateral boundary instability.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0015, SNOW/CLOUD DISCRIMINATION
F.R. VALOVCIN, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF249500)

AF function - weather analysis and forecasting for military operations. Deficiency - lack of adequate information to meet military weather support requirements. Objective - to recommend operational techniques and an optimum sensor design to AWS/SAMSO to discriminate clouds and snow backgrounds. How development contributes - provides an efficient and unambiguous operational procedure for distinguishing clouds from snow backgrounds as well as distinguishing ice clouds from water clouds.

Analyses of magnetic tapes of previously collected aircraft snow/cloud measurements using digital conversion and Fourier analysis equipment will be initiated. Additional observations using the optical physics instrumented KC 135 aircraft will be made to acquire a representative sample of snow and cloud measurements under a variety of meteorological conditions. Based on the analyses of these data, a recommendation for an operational instrument will follow.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0016, ALTITUDE PROFILE OF NEUTRAL THERMOSPHERIC COMPOSITION AND DYNAMICS
W.K. VICKERY, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF248950)

AF function - operate missiles and satellites in and through the upper atmosphere. Opportunity - the DMSP supplementary sensor density package (SSD) requires calibration in order to assure accurate global measurements of atmospheric density. Objective - measure the density profile of major neutral atmospheric species with near-simultaneous measurements of the dynamical structure of the region between 90 and 180 kilometers. How research contributes - provide profile of major neutral species, turbopause altitude and thermospheric temperature profile needed as inputs for the calibration of the DMSP(SSD) package.

Each set of measurements involves two rocket payloads. One payload contains a specially designed neutral mass spectrometer to measure the density of each of the major atmospheric species. The other will dispense a vapor trail for dynamics measurements (including eddy diffusion coefficients, molecular diffusion and turbopause altitude data and temperature measurements). These measurements are combined with measurements of solar UV absorption, electron energy distribution and airglow radiation for a set of essential inputs to support the SSD calibration. The data are collected from the mass spectrometer by telemetry and reduced in terms of the neutral species distribution. Atmospheric dynamics parameters are determined from analysis of time lapse photographs of vapor trails yielding wind, wind shear and temperature profiles, diffusion coefficients, and indirectly, total neutral density. Two sets of measurements are planned, one in FY77, a second in FY78.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0017, MICROPULSATIONS AND HYDROMAGNETIC RESONANCES
M.P. HAGAN, Emmanuel College, Graduate School, *Boston, Massachusetts* 02115 (DF275240; F19628-76-C-0013)

AF function - detection of artificial magnetospheric disturbances. Deficiency - lack of understanding of magnetosphere. Research -theoretical studies leading to solutions, in closed form, of the propagation equation. How research contributes - increases probability of detecting high-altitude nuclear detonations in the presence of natural disturbances. Design, develop and fabricate hardware modifications to the data processing system which handles experimental data returned from the micropulsation network. Investigate the nature of the singularities appearing in the differential equations governing the propagation of hydromagnetic waves in the magnetosphere and their effects on resonance phenomena for the modes. For certain magnetospheric models closed solutions are obtained and are given by cylindrical functions of a very high order. The nature and properties of these solutions, particularly in the neighborhood of the critical points, are to be investigated. Study phenomenological parameters of micropulsations, and compare such things as polarization, and latitude and longitude resonance effects with analytical results.

Data from the AFGL magnetic activity network arrives at the acquisition center in a sequential coded digital form on a single leased data line. The contractor will provide for the design and implementation of hardware and software to continue to process and reduce these data on a 24-hour-a-day basis for a period of several years. The design approach is to configure a system utilizing the existing dedicated mini-computer adding peripheral hardware and interfaces as required together with all necessary supporting software. Final forms of the data to be produced will include (1) archive tapes containing all of the basic data converted to engineering form and corrected for all known effects, (2) special tapes of reduced data for instrument, computer and transmission line diagnostics and (3) summary plots and magnetograms of selected data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0018, AXISYMMETRIC MHD SOLAR WIND THEORY
R.L. CAROVILLANO, Boston College, School of Arts & Sciences, *Chestnut Hill, Massachusetts* 02167 (ATM77-11690)

This grant will support a study of axisymmetric solar wind theory. The basis for the work is a new equation governing axisymmetric ideal magnetohydrodynamic (MHD) flow. The purpose of the work is to extend the analysis of the equation, to obtain analytical solutions, and to develop applications to the solar wind. Areas to be studied include: critical surfaces, mathematical properties of the equation and its solutions, analytical solutions, the variational principle from which the equation is derivable, perturbation theory, propagation of disturbances, the relativistic generalizaton of the equation, and applications to solar research such as coronal holes and the heliosphere.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0019, ATMOSPHERIC NEUTRAL TEMPERATURE
D.F. KITROSSER, Univ. of Lowell, Graduate School, *Lowell, Massachusetts* 01854 (DF248570; F19628-77-C-0090)

AF function - calibration of the DMSP-SSD package. Deficiency -calibration of DMSP-SSD density package to assure accurate measurements of atmospheric density. Research - determine the temperature variation of the atmosphere around the time of DMSP-SSD over-fly. How research contributes - atmospheric temperature models will be integrated into the overall model of the atmosphere at the time of the DMSP calibration.

The temperature profile will be measured by observing the resonance fluorescence of the A10 molecules which are temperature equilibrated with the local atmosphere.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0020, REMOTE SENSING OF THE ENVIRONMENT
B.O. BENN, U.S. Army, Waterways Experiment Station, *Vicksburg, Mississippi* 39180 (DA0N8025)

To evaluate remote sensing techniques, existing or under development, for obtaining data relevant to the detection and monitoring of environmental changes induced or sustained by the construction and operation of military facilities, and to provide managers and planners with instructions on how to utilize pertinent methods. Results of the research program will provide managers and planners with guidance for rapid acquisition of data for evaluation of the impact of military construction and base operation activities on the environment. Appropriate technical manuals will be revised or developed to improve master planning and facilities management capabilities by the use of remote sensing techniques.

Specific data needs for environmental planning and baseline description will be identified in coordination with the Construction Engineering Research Laboratory (CERL). Guidelines for establishing parameters that define the environmental baseline and the effects of a base activity will be developed. Techniques for evaluating the applicability of remote sensing for measuring the parameters will be developed with emphasis on providing the user with a rapid means for optimizing the choice of sensor systems for a specific purpose and under specific conditions in terms of data accuracy, cost, and objective.

SUPPORTED BY U.S. Dept. of Defense, Office Chief of Engineers, Construction Engineering Research Lab.

5.0021, SATELLITE DENSITY ACCELEROMETER
W. LANGE, Bell Aerospace Company, *Buffalo, New York* 14240 (DF279890; F19628-76-C-0120)

AF function - airborne surveillance, target acquisition. Deficiency - atmospheric density variations with time and space cannot be accurately predicted. How research contributes - permits development of accurate density forecasting techniques. The objective of this work is to build one flyable atmospheric density accelerometer system. The instrument will be flown on the Air Force low-altitude satellite CRL-247 planned for launch in 1977. Atmospheric density is determined from measurement of the satellite deceleration caused by aerodynamic drag. It is anticipated that measurements will be made at altitudes from about 130 km to 300 km.

Roca consists of a single axis accelerometer mounted on a rotatable base. Atmospheric density is calculated directly from aerodynamic drag measurements. Inherent accelerometer bias errors must be determined for accurate density determination on low-eccentricity, non-spinning satellites. Roca provides a capability for orbital bias determination. In its normal mode the instrument is flown with its sensitive axis aligned with the satellite velocity vector. The instrument output consists of aerodynamic drag plus bias data. By rotating the sensitive axis perpendicular to the velocity vector aerodynamic drag is not sensed and bias is determined directly. This technique will permit highly accurate drag measurements in the altitude region of about 130-300 km.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0022, OBSERVATION OF VHF BEACONS ON SATELLITES
K. PAI, U.S. Army, Res. Office, *Durham, North Carolina* 27706 (DF580020; AF-AFOSR-0215-74)

AF function - navigation. Deficiency - signal fading, pulse delays, refraction errors. Objective - measures ionospheric parameters related to geomagnetic activity. How research contributes - results used to develop global predictive models of scintillation and total electron content. Models support AFSATCOM and GPS development. Work is done in conjunction with the Joint Satellite Studies Group.

Signals from transmitting satellites will be monitored to determine morphology and statistics of ionospheric total electron content and scintillation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0023, LATERAL VARIATIONS IN GEOLOGIC STRUCTURE AND TECTONIC SETTING FROM REMOTE SENSING DATA
S.S. ALEXANDER, Penn. State University, School of Earth & Min. Sci., *University Park, Pennsylvania* 16802 (DF048870; AF-AFOSR-3340-77)

AF function - DoD has as one of its missions to improve the U.S. capability for the detection and identification of underground nuclear explosions. Deficiency - the knowledge on how different geological structures affect the yield determinations of underground nuclear explosions is only known to factor ratio of three to five. To adequately monitor the Threshold Test-Ban Treaty this factor should be reduced to at least 1.5. Objective - the principal objective of this research is to assess the usefulness of remote sensing digital imagery (LANDSAT multispectral scanning data) for inferring lateral variations in geological structure and tectonic setting. Contribution - this research will determine the extent to which these inferred variations correlate with observed variations in seismic excitations from underground nuclear explosion for the various test sites in the Soviet Union.

The research will take advantage of the unique capabilities available in the Office of Remote Sensing of Earth Resources (OSRER). The principal types of digital analysis proposed include: (1) classification mapping of soils and vegetation using supervised and/or unsupervised cluster analysis, (2) principal components and canonical analysis, (3) wave-number analysis to determine the predominant scale and orientation of distinctive patterns, (4) wave-number filtering to enhance and map features of any desired spatial dimension and orientation, and (5) spatial and temporal derivative operations to map zones of rapid change. A variety of signal enhancement techniques are available if needed. The most promising technique will be developed into a composite processing package for application to any desired geological structure on a global basis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

5.0024, NUMERICAL DIAGNOSTIC ANALYSIS OF SERIES OF SATELLITE PHOTOGRAPHS 13734-GS
J.C. FREEMAN, Inst. for Storm Research Inc., *Houston, Texas* 77006 (DA0E9272; DAAG29 77 G0013)

To adapt variational and optimization principles to the analysis of meteorological satellite data and mesoscale storms in the atmosphere. Relevance - the Army needs a quantitative technique or model which can fully utilize the detailed data offered by the frequent-interval meteorological satellite observations in a quantitative way for analysis and prediction of severe storms and other mesoscale weather conditions that affect military operations. In particular, this technique could enhance the Army automatic meteorological system being developed at WSMR.

A variation scheme will be used for finding unknown quantities that fit a time history of measurements of measureable quantities. Data will be extracted on cloud radiance, motion, height and form from the synchronous meteorological satellite over several

time steps to develop a set of initial conditions compatible with these data and the equations of motion for a 3-active layer model of the atmosphere.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Army Research Office

5.0025, A STUDY OF ION DYNAMICS AND RELATED EFFECTS AT MiDDLE AND HIGH LATITUDES
J. ST. MAURICE, Utah Higher Education System, Center for Res. in Aeronomy, *Logan, Utah* 84321 (ATM76-82323)

This grant funds a theoretical and data-analysis study of ion dynamics and related effects at middle and high latitudes. In particular, it funds: 1. Continuation of a study of non-Maxwellian ion velocity distributions in regions of fast ion convection at high latitudes, with emphasis on the effects of these non-Maxwellian distributions on measurements. Measurements to be analyzed include retarding potential analyzers and incoherent scatter radar. 2. A study of the dynamics and chemistry of fast convecting regions in the auroral ionosphere, using data from the Atmosphere Explorer satellites, and 3. A study of chemical reaction rates, to determine how to interpret laboratory measurements of reaction rates for application to the ionosphere when non-Maxwellian velocity distributions are involved.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0026, STUDIES OF EXTRATROPICAL CYCLONIC STORMS (THE CYCLES PROJECT)
P.V. HOBBS, Univ. of Washington, School of Arts & Sciences, *Seattle, Washington* 98105 (ATM77-01344)

The objective of this research is the observation and interpretation of meteorological events on the synoptic, mesoscale, and cloud microphysical scale. These observations will be obtained using airdraft, Doppler radars, radiosonde ascents, and a special surface network of observing stations. These data will, it is hoped, extend and confirm previous observations revealing the mesoscale featues of rainbands accompanying cyclonic disturbances in the Pacific Northwest and the apparent ineffectiveness of the Bergeron-Findiesen process in producing natural rainfall.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, CONTRIBUTION OF MOTION TO TRAINING
E.L. MARTIN, U.S. Air Force, Human Resources Laboratory, *Chandler, Arizona* 85224 (DF222010)

1. To determine the contributions of simulator motion to the acquisition of flying skills for the purposes of identifying the most cost-effective hardware configurations for utilization of existing systems and for future procurement. 2. To develop a measurement methodology for determining the effects of motion on performance during skill acquisition.

The contact flying skill contact of the T-37 phase of UPT training has been categorized into four areas: 1. Basic contact skills, 2. Takeoff/landing skills, 3. Aerobatic skills, and 4. Formation skills. A series of experiments will be conducted to determine the contributions of simulator motion to these skill areas. The development of the studies will follow a branching logic in which the most costly configurations are compared with the least costly. Intermediate configurations would be investigated in the event that the most costly were found to be significantly superior. All studies will employ a transfer of training paradigm using T-37 UPT students as subjects. The advanced simulator for undergraduate pilot training (ASUPT) will be used for the simulator training phase of each study.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0002, STUDY OF THE AIR TRAINING COMMAND INSTRUCTOR PILOT
G.B. REID, U.S. Air Force, Human Resources Laboratory, *Chandler, Arizona* 85224 (DF222960)

To investigate IP perceptions of the UPT mission, his role in that mission, and his attitude toward his student pilots. To determine how IPs should be trained to handle IP-student pilot interpersonal relations and to make recommendations for increasing the effectivenss of IP-student pilot interactions. Additional objectives are to investigate the attitudes of the IP toward use of simulators in flying training and to the use of simulators to satisfy performance requirements in IP skill maintenance.

The technical approach is as follows: (1) conduct a literature review of the psychology of teaching and learning and on educational technology relevant to IP-student interactions, (2) conduct interviews at Williams AFB, AZ, with instructor pilots to determine areas of information relevant to the IPs' perceptions, roles, and attitudes, (3) construct a questionnaire from the information obtained in the interviews, and (4) administer the questionnaire to IPs at Williams AFB. The questionnaire and literature review data will then be synthesized to develop specific recommendations for improving the effectiveness of the ATC IP.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0003, INSTRUCTOR PILOT'S ROLE IN SIMULATOR TRAINING
V.J. SHARKEY, U.S. Navy, Human Factors Laboratory, *Orlando, Florida* 32813 (DN494046)

The objectives of this effort are to define the role of the instructor pilot in simulator training, to determine the feasibility of developing training for instructor pilots and to specify the design of the instructor station for use by instructor pilots and training device personnel.

The effort will consist of the following: (a) review prior and current research and development relevant to the design and use of instructor consoles with particular emphasis on instructor stations for OFT's, (b) specify pilot instructor training goals in OFT utilization, (c) develop a candidate design for an instructor pilot console based on the above specifications, (d) carry out a series of experiments in the simulation facilities, to specify the final design of an instructor pilot console for use with an OFT, and (e) demonstrate the feasibility of using the console as an instructor pilot training device.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Training Equipment Center

6.0004, IMPROVING FLEET EFFECTIVENESS THROUGH IMPROVED NAVY AND MARINE CORPS AIRCREW PERFORMANCE ASSESSMENT
J.H. ASHBURN, U.S. Navy, Aerospace Medical Res. Lab., *Pensacola, Florida* 32512 (DN141808)

Development and implementation of systems for forecasting likelihood of training completion has reduced costly attrition and resulted in improved fleet effectiveness. Among aviators and naval flight officers who complete training, however, substantial costs are still incurred through attrition in replacement training squadrons (RTSs) and a continuing incidence of marginal and unsatisfactory fleet performance, reflecting both individual differences in capability and problems in training and RTS syllabi. Identifying relevant differences in skill and ability and optimizing syllabus responsiveness to operational demands requires valid and reliable performance measurement. The objective of this work unit is to develop improved methods for assessment of aircrew performance and to utilize performance data in recommendations for improved fleet effectiveness.

Standardized objective and subjective performance assessment methods will be developed and evaluated, and elements critical to fleet performance determined. Analyses of fleet requirements will relate critical performance data elements to aircrew capabilities. Problems in specialized training, aircrew selection and assignment standards and job modification will be identified and solutions recommended.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Aerospace Medical Research Lab.

6.0005, LONG-TERM PULMONARY EFFECTS OF REPEATED USE OF 100 PERCENT OXYGEN
R. BASON, U.S. Navy, Aerospace Medical Res. Lab., *Pensacola, Florida* 32512 (DN477051)

This study is directed toward determining if repeated exposure to high-performance jet environment including 100% oxygen usage over the course of a naval aviation career produces any significant change in pulmonary functions.

This study will compare pulmonary function studies obtained from a group (n equals 100) of high-performance jet aviators who are repeatedly exposed to high oxygen concentrations, high altitude and high g forces while flying, to a group of transport/helo pilots who are not exposed to these factors. The two groups will be age matched, have similar smoking profiles, have similar total flying hours and be free of significant pulmonary complaints.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Aerospace Medical Research Lab.

6.0006, HUMAN PERFORMANCE IN AVIATION SYSTEMS
C.O. HOPKINS, Univ. of Illinois, Inst. of Aviation, *Urbana, Illinois* 61801 (DF041940; F44620-76-C-0009)

AF function - this research program investigates human factors problems that are basic to AF flight operations. These factors relate to aerospace system display and control design, crew selection and training, visual and motion cues in flight simulators, training and transfer of training to airborne situations, and performance assessment and prediction in flight training. Deficiency - the contribution of different levels of fidelity which visual and motion systems make in simulators to performance efficiency aloft requires elucidation. Methods for predicting success in flight training and for assessing proficiency during training are inadequate, as are methods for providing computer-managed programs of flight instruction with feedback on performance to students and instructors alike. Human operator interactions with aerosystems displays, and information processing capabilities under overload conditions requires more definitive elaboration. Objective -this research is designed to enhance man-machine system effectiveness by investigating human factors problems in airborne system design, training, and operation. How research contributes - this program provides a continuing flow of scientific and technical information useful to aerospace systems designers, training managers, and developers of training systems.

Research will be undertaken in the areas of attention, timesharing and pilot performance, transfer of computer-assisted learning to flight, computer-assisted decision training for air combat tactics, acquisition and transfer of aircraft landing skills through manipulation of augmented visual cue structure, perceived size and distance as correlates of visual accommodation during pilot maneuvers, and synergistic displays for complex navigation and control tasks.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0007, WIDE-ANGLE, MULTI-VIEWER INFINITY DISPLAY STUDY
J. MACKEY, McDonnell Douglas Elec. Co., *St. Charles, Missouri* (DF227950; F33615-76-C-0052)

The purpose of this study is to develop a design for a wide-angle, multi-viewer infinity display system for use in visual simulation. Current multi-viewer display systems provide a relatively narrow field-of-view. State-of-the-art wide-angle displays are limited to only one viewer. With this study, the technology to provide a continuous wide-angle, color infinity image to the cockpit crew in a flight simulator will be investigated. A display system based on this initial design study is intended to increase the number of missions which can be trained in simulators for bomber, cargo, and tanker-type aircraft and will provide more effective training.

Representative visual simulation display requirements for bomber, tanker, and cargo-type aircraft have been developed. These requirements include viewing for all crew members requiring visual contact with the terrain, provisions for mounting on a motion platform, image quality parameters and color television-type input. Using these requirements, this study effort will develop a design definition and will describe any technical areas which require further research. The study will review current technologies and explore near-future technologies for the basis of selecting a display technique. The main study area will be the optical design of the display system and the feasibility of manufacturing these optical devices. Other areas of study include interfacing the display system with the motion platform, simulator cockpit, and the television image input device. It is anticipated that this study will result in a paper-design and that additional development will be required before this design can be implemented in hardware.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0008, NAV/BOMB NAV CREW STATION DESIGN AND PERFORMANCE ASSESSMENT
G.P. CHUBB, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF319140)

To obtain quantitative data for a representative sample of Strategic Air Command (SAC) combat-ready crew members that appropriately reflect the workload imposed by the current equipment layout of the B-52G/H offensive avionics crew station. These data will serve as the basis for relative comparisons in the evaluation of proposed changes to the crew station. Long-range planning and study priorities are established by the Strategic Avionics Task Force and its action office is directed to pursue specific studies, such as the low life cycle avionics study (ASD/AES). As the low life cycle cost avionics study recommends prototype design concepts, these will be tried and evaluated against the same mission scenario as used in the SACDEF baseline study. The objective is to provide a quantitative assessment of both man and machine prior to hardware development commitments.

An existing combat crewstation simulator was obtained and instrumented to detect when particular switches were set and to what position. SAC/XOBB was tasked to prepare a mission scenario that would properly assess the kinds and types of tasks the navigator and radar navigator are expected to execute in an emergency war order mission. SAC/DOTN was tasked to provide survey data on their combat-ready crews so a selective, representative sample of 24 teams could be sent TDY to participate in the study. Selected measures of operator and system performance will be monitored by computer. Radar scope photographs and video tape recordings were also used to collect supplementary data. Crews were thoroughly debriefed after the scenario was completed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0009, CREW WORKLOAD/SIZING REQUIREMENTS
B.M. CRAWFORD, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321030)

The objective of this work unit is to establish a quantitative basis for specifying system manning levels (crew sizes) consistent with actual workloads dictated by mission demands. The associated methodology will be derived from information flow rates, information processing functions and information metrics critical to mission performance goals. The quantitative methodology and data base, when combined with task and time line analyses during system design, will result in more efficient crew system performance and minimize the number and cost of system modifications. Special attention shall be given to assuring integration of crew capabilities with computer aiding techniques. This effort supports AFSC development goals, TC-1, TC-2, TC-7, C3-3, RI-1, and MS-4.

Specific directions for this effort will be derived initially from reviews of ongoing crew sizing evaluations for the C-135, C-141, C-5, AMST and ACTA systems. Techniques currently being developed by AMRL to assess task load capabilities of individual operators in terms of basic information/task parameters and information processing functions will be adapted to incorporate crew interactions, time and task sharing effects. The quantitative methodology as developed will be pre-tested on multi-man system simulations in the AMRL computer simulations facility. The resultant quantitative transfer functions, expressive of relation-

ships between interface design, processing functions, rate of information input and mission task effectiveness criteria, will be (1) integrated with a computer-based system analysis program (e.g., SAINT), (2) documented in procedural handbook form, and (3) validated on a new multi-man system development effort.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0010, HEAD AND EYE MOTION IN MOIFE
C.B. HARRAH, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321260)

The objective is to quantitatively describe the motion of the head and eye in multiple axis vibration environments associated with low-level high-speed flight. These descriptions will be in the form of transfer functions or describing functions. These functions will have two uses which are (1) to predict the efficacy of helmet-mounted display and pointing systems in turbulent and buffeting flight environments and (2) as a subcomponent of a predictive model for visual performance in multiaxis oscillating inertial force environments (MOIFE).

The first step will be to quantitatively measure head motion. Several methods will be attempted including miniature accelerometers and helmet-mounted sight systems. Upon satisfactory completion of the head measurements the eye measurements will be undertaken. At this point in time these measurements are expected to consist of transfer functions derived from information concerning phase shifts and motion amplitude changes needed to stabilize oscilloscope patterns in the visual field of a subject undergoing whole body vibration.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0011, DETERMINATION OF G-CUE ENVIRONMENTS
J. LOCH, U.S. Air Force, Human Resources Laboratory, *Dayton, Ohio* 45433 (DF228230)

To determine the pilots' g-cue environment of various respresentative aircraft under typical maneuvers. The results will be applicable to the development of future motion and force systems including the advanced low-cost g-cuing system. The end product of this work is a data base of representative aircraft g-cue environment profiles. No technical report will be published.

The approach is to collect data through use of the computer flight models for the various aircraft under typical maneuvers. Flight models of representative aircraft will be used such as F-15/16 (fighters), C-130 (cargo), and AMST (transport). The output accelerations will then be transferred from the aircraft center of gravity (e.g., point) to the pilot seat using the aircraft angular velocity, acceleration, and position vector to the seat location. A compilation and evaluation of the data will be performed to determine the g-cuing simulation needs for such aircraft types under typical maneuvers and to gain a better understanding of their motion and force simulation requirements. The LAMARS facility at the AFFDL will be used to obtain much of data desired on the effort. This information will be obtained by 'piggy-backing' the study with planned aircraft handling qualities studies. The LAMARS cockpit will not be used in this study. Only the LAMARS computational system will be required.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0012, BIOASSAY IN SOIL MICROORGANISMS
S.A. LONDON, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF320500)

To utilize microbial systems for evaluating the potential environmental impact of various materials used in Air Force operations, such as missile propellants, aircraft fuels and lubricants and other substances used in consequential amounts that could have acute and/or chronic environmental effects. The data derived from this effort are considered in conjunction with similar results obtained with other biological indicator and test systems to form a data base upon which scientifically valid environmental impact assessments and statements can be prepared. The microbial bioassay portion of work unit 6302-04-11 was transferred to this work unit.

Microbial cultures isolated from soil samples will be investigated concerning their responses to both acute and chronic exposure to potential environmental pollutants. Selection of species will be based upon: (1) applicability of physiological requirements to experimental procedures, (2) relationship of responses to pollutant exposure with ecosystem impact. Microbes will be studied under both closed (batch) system and open (steady-state growth) system conditions to ascertain acute and chronic effects. Responses to be evaluated will include growth kinetics, bacteriocidal/bacteriostatic effect, physiological changes, genetic (mutation) effects, pollutant degradation or accumulation. This effort will establish no-effect levels for single and multiple cultures and will serve as both a laboratory test system and a means of predicting potential environmental consequences of inadvertant intrusion in soil and water of Air Force materials.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0013, QUANTIFICATION OF VISUAL PERFORMANCE
S. MACLEOD, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF320910)

To provide basic psychophysical and electrophysiological data for evaluation of display parameters on sensory processing of information. To define and exploit the sensory processing capabilities of the peripheral visual field. To develop psychovisual channel capacity measures relatable to electronic display capacity measures. To develop threshold and suprathreshold describing functions of the visual system for both monochrome and chromatic information. To relate psychophysically derived data to characteristics of the visual evoked response (VER) waveform. To define the sensitivity of both steady-state and transient VERs to degraded display conditions. Specific products of this effort are used in other task elements to establish display design criteria and performance requirements for target acquisition, weapon delivery and optical countermeasure applications. Products of this work unit support AFSC development goals TC-1, TC-7, C3-3, and MS-4.

A 5-channel Maxwellian view optical system will be used to precisely control stimulus parameters. The visual response lab will be used for on-line collection and analysis of VER data. Equipment required to control parameters of peripherally presented information will be developed and incorporated into the visual response lab. Initial experiments will provide suprathreshold just noticeable differences (JNDs) as a function of spatial frequency. These will provide the basic data to permit scaling of ordinate axis values on graphs of unitary image quality measures. Threshold describing functions will be generated as a function of waveform (sine and square), adaptation level, color, and orientation of gratings. These data will be used to define a 'standard observer' threshold describing function to be used in unitary image quality measures. Isocontrast describing functions (or families of suprathreshold describing functions) will be developed and applied to unitary image quality measures to determine which best correlate with operator performance. Correlations between VER characteristics and suprathreshold psychophysical data will be established in an attempt to simplify the collection of describing function data. Target-to-background contrast (in terms of spatial frequency, color and luminance) required for target detection will be determined for input to target acquisition models.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0014, BASIC VISUAL PERCEPTUAL PROCESSES FOR DISPLAYS
W.L. MARTIN, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF322970)

To develop basic laboratory data related to the suprathreshold perception of simple waveform targets in the visual periphery. To develop the fundamental data required to adequately model visual system functioning for the off-axis detection of simple targets varying in both the spatial and temporal domain. To develop spatiotemporal contrast sensitivity functions at various locations in the visual field to allow definition of optimal stimulus parameters for those locations.

Initial FY 77 studies will be conducted using facilities already constructed for support of the windscreen evaluation program (work unit 71841803); these facilities will permit eccentric viewing of a video monitor up to plus or minus 90 degrees from the foveal along the horizontal, vertical, as well as oblique meridians, with complete control of contrast and spatial and temporal frequencies. FY 78 studies will require fabrication of a special purpose electronic signal generator to provide control over target position, size, spatial frequency content, luminance and contrast characteristics, independent from the background parameters which will be similarly controlled. Target-to-background contrast required for alternative levels of probability of detection and time to detection for on-axis as well as various off-axis viewing angles will be defined. These data are crucial for development and testing of multiple-channel hypotheses of visual system functioning for both foveal and peripheral viewing. This basic research directly supports exploratory development efforts documented under work units 71840450, 'Cognitive Aspects of Visual Performance,' and 71840451, 'Quantification of Visual Performance.'

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0015, TECHNOLOGY APPLICATION TO OPERATIONAL NOISE PROBLEMS

C.W. NIXON, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321390)

Air Force regulation 161-35 on hazardous noise exposure, which sets forth the AF noise abatement program, assigns responsibility to the Biological Acoustics Branch to provide consultation and technical assistance on personnel safety and effectiveness problems that are beyond the capabilities of the base. The objective is to provide consultation and apply the current technology base to the wide range of acoustic problems found in AF activities.

The approach is to conduct laboratory and/or field evaluations of specific problems or items of equipment to define the threat potential to health and performance capability and propose satisfactory solutions that comply with AF policies. Individual efforts are usually short-term and include technical questions relating to sonic boom, noise exposure limits, ultrasound, infrasound, impulsive noise, communication equipment and hearing protection. Specific efforts include problems such as flight helmet effectiveness, communication with a fire fighter's helmet and with a new oxygen mask microphone in noise. Requests originate from all levels of AF and other governmental agencies and specifically include base flight surgeons, bio-environmental engineers, systems development offices and the life support SPO.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0016, RESEARCH STUDIES AND ANALYSES OF BIOTECHNOLOGY R&D TASKS

J. MILITELLO, Univ. of Dayton, Res. Inst., *Dayton, Ohio* 45409 (DF317290; F33615-74-C-5116)

Many unforeseen problems arise during the conduct of the laboratory's R&D programs which require special and immediate assistance not available except through contract arrangements. This contract effort provides whatever expertise is necessary for rapid solution in these situations. This is an extremely cost-effective method of supporting all areas of research and exploratory development of the laboratory including biodynamics, cybernetics, environmental medicine, toxicology, human engineering and performance studies as well as related support of many AF development and operational systems.

This contract provides intermittent studies, analyses, experimentation and technical services for all areas of the technical program, thereby avoiding costly delays in the laboratory's mission activities. Tasks are fully described through the contracting officer and made on a call basis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0017, THE DEVELOPMENT AND EVALUATION OF OBJECTIVE FREQUENCY DOMAIN BASED PILOT PERFORMANCE MEASURES IN ASUPT

E.D. MCDOWELL, Oregon State Higher Educ. Sys., School of Engineering, *Corvallis, Oregon* 97331 (DF048250; AF-AFOSR-3294-77)

AF function - the development and evaluation of frequency domain measures of pilot performance is of high interest to Air Force flying training personnel and consistent with current and planned Air Force research efforts in the area of performance measurement. Deficiency -considerable controversy exists concerning the relative merits of frequency domain versus time domain measures. The research proposed represents a major step toward resolution of the conflict which could have significant impact upon the design of future operational performance measurement systems. Objective - the possible advantages of frequency domain performance measures over more conventional time domain measures will be assessed. How research contributes - the successive organization of perception hypothesis would suggest that as human operators become more proficient at systems control tasks, their control input power spectral density curves will shift toward lower frequencies. If this hypothesis were shown to hold for flying, then it could provide the basis for developing parsimonious non-maneuver specific pilot performance measures.

Measures of pilot performance based upon a frequency domain analysis of his control inputs will be developed and then validated by comparison with instructor pilots' subjective ratings. Discriminability of these measures will be determined by demonstrating their sensitivity to pilot experience level and their marginal utility will be determined by comparing their discriminating power to those of conventional time domain criteria. The effects of simulator platform motion on instructor pilot rating abilities will be determined, and the desirability of using expanded IP rating scales in the subjective evaluation of pilot performance will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0018, DISPLAY DEVICE VISUAL CRITERIA

G.T. CHISUM, U.S. Navy, Crew Systems Department, *Warminster, Pennsylvania* 18974 (DN481351)

To determine the capabilities and limitations of the human visual system under airborne operational conditions requiring the use of advanced display devices, and to specify the visual criteria which the designs of advanced display devices must meet. The criteria must be enumerated in such a fashion that they can be readily used by the engineers and physical scientists who design and develop the displays. The requirement for this work unit was established by GOR 45.

Visual performance data will be collected using basic laboratory techniques. That data will be used to specify the visual design criteria and constraints for visual displays for sighting, tracking and detection devices. Experimental and theoretical evaluations of proposed and prototype devices will be performed and recommendations based on the results of the evaluations will be made.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

6.0019, CARDIAC CHANGES DUE TO ACCELERATION

H.L. STONE, Univ. of Texas, School of Medicine, *Galveston, Texas* 77550 (DF037940; AF-AFOSR-2622-74)

AF function - aircrew personnel operating high-performance aircraft are exposed to increasing levels of rapid-onset, sustained, repetitive maneuvering forces. It has been recognized that cardiovascular responses can be encountered which may be particularly important in determining performance and severely limit or restrict the capabilities of the aircrew. Deficiency - the etiology of noted cardiac abnormalities associated with acceleration remains obscure. Accumulated evidence suggests there may be failure of the blood supply to the inner surface of the heart. Miniswine have been used in a number of acceleration studies since it was determined that they exhibited cardiac pathologies following exposure to high levels of acceleration. There is some question regarding possible species susceptibility. Objective - this effort will define morphological cardiac responses of miniswine to selected levels

of stress. How work contributes - this research is in direct support of RO 1.6 'Mechanical Forces' and supplements ongoing projects at AMD.

Miniswine will be conditioned through treadmill exercise. These and control subjects will be exposed to acceleration stress and cardiac changes compared.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0020, AEROMEDICAL DESIGN AND ENGINEERING ANALYSIS

C.S. ACOSTA, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322120)

To provide aeromedical design and engineering support to major commands for biomedical systems developed by USAFSAM and accepted for operational use. Prepare instructions and maintenance information for equipment users, and prepare technical reports to document completed R&D efforts.

Prepare required acquisition documentation, monitor systems acquisition, provide operation and maintenance instructions to system users, assist in identifying and eliminating operational deficiencies, and prepare required USAFSAM technical reports upon completion of development efforts. This work was previously documented under work units 7755-15-01 and 7996-02-AA.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0021, BIOMEDICAL CRITERIA FOR ADVANCED RESPIRATORY LIFE SUPPORT SYSTEMS

F.W. BAUMGARDNER, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322500)

The performance of aircrew breathing systems must insure adequate physiological function to users in diverse operational environments. In dynamic operation current inventory regulators waste oxygen, exhibit flow limitations, and impose physiologically stressful breathing pressures on the cardiopulmonary system of the user. The primary objective of this work unit is to establish concepts and data for the development of systems which optimize oxygen delivery to aircrew of advanced and conceptual aircraft. Additionally, individual ventilation requirements under various flight profiles and levels of physiologic stress will be assessed with reference to current equipment as well as the development of new-generation oxygen delivery systems. These efforts are coordinated with ASD/AEL on a continual basis in accordance with letters of agreement and with ASD/ENECE in accordance with TN-ASD-AMD-SAM-0103-77-61. Close technical liaison is maintained with Oklahoma City ALC, ASD/ENESS, NADC and USAARL. Previous accomplishments in this area are documented under workunits 71641717 and 71641718.

Laboratory studies as well as informal reports from the operating commands have indicated that current military specifications for oxygen supply and the delivery equipment do not adequately meet man's respiratory requirements in high-performance aircraft now being deployed. Efforts through FY 78 will be oriented toward providing ASD with standards for revising MIL-R-83178, Specification for Oxygen Regulators, and MIL-V-27296, Oxygen Mask Inhalation, Exhalation Valve. These efforts will include investigation of physiologic parameters such as instantaneous ventilatory flow, ventilatory pressure, tidal volume, respiratory frequency, inspiratory acceleration, minute ventilation and oxygen consumption. The physiologic effects of current inventory equipment such as hose length between oxygen regulator and mask will also be examined. Standards derived from physiologic studies will be reported to ASD/ENECE, in accordance with the requirements of TN-ASD-AMD/SAM- 0103-77-61, and to ASD/ENESS for incorporation in appropriate AFSC design handbooks.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0022, CRITERIA SUITABLE FOR G-SUIT/G-VALVE EVALUATION IN A HIGH G ACM ENVIRONMENT

R.R. BURTON, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322330)

To develop criteria useful in evaluating g-protection resulting from anti-g suits and valves during aerial combat-type acceleration exposures.

A simulated aerial combat maneuver (SACM) developed in 7930-03-49 will be used testing plag seat 2 which is capable of several seat back angles offering various levels of relaxed g-tolerance. Several physiologic parameters will be determined during exposure to the SACM. Relaxed g-tolerances will be correlated with these parameters and the duration of SACM tolerated by several subjects. A significant correlation will verify the use of the SACM as a method of quantifying tolerance to a high variable g-environment and as a tool useful in measuring ACM type of g-protection resulting from the use of anti-g suits and valves.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0023, DESIGN AND QUALITY CONTROL CRITERIA FOR UPGRADED MULTILAYER WINDSCREENS

C.P. HATSELL, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322650)

Specify optical design and quality control criteria for multilayer aircraft windscreens to optimize system safety and effectiveness.

Apply techniques of geometrical optics and optical physics to develop methods of and devices for quantifying windscreen distortion, and relate these distortion measures to windscreen geometry and materials. Determine the feasibility amd materials specifications for antireflectant coatings to reduce multiple imaging phenomena in thick windscreens of complex geometry. These measures and specifications will direct materials and manufacturing technology toward windscreen improvement for enhanced operational capability.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0024, THE EFFECTS OF RADIATION-INDUCED NAUSEA/VOMITING ON CREW PERFORMANCE

J.L. MATTSSON, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF314470)

To continue development of a central repository for emetic data collected from all ionizing radiation experiments conducted at, or under the auspices of SAM. This growing data base will progressively allow for more accurate predictions of crew performance in a nuclear environment. Specific data elements are radiation dose, dose rate/dose profile, dose quality, onset time to emesis, duration of emetic episodes, offset time, number of emetic episodes, productive/nonproductive, incidence of emesis, effect of fasting time, and impact of emesis on task performance.

Tabulate data from all radiation experiments on special forms for computerized data banking and retrieval, and for computerized mathematical analysis and graphic representation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0025, STANDARDS FOR PERIODS OF EXCUSAL BETWEEN CHAMBER TRAINING & AIRCRAFT FLIGHTS

R.M. OLSON, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF323230)

Air Force missions regularly expose aircrew members to cabin altitude as high as 25,000 feet for periods up to an hour. Consequently, decompression sickness is a potential hazard. Regulations require that aircrews periodically take refresher courses including altitude chamber training. The Air Force Surgeon General has raised the question as to the optimal grounding time between altitude chamber training and routine aircraft flights. On the one hand, excessive grounding times or periods of excusal are wasteful of manpower, on the other hand, too brief periods of excusal will increase the potential for decompression sickness. Recent advances in Doppler technology provide a new

approach to determine incipient bends. The object of this effort is to use this new technology to determine the optimal periods of excusal between training and prolonged altitude exposures.

The effect of routine altitude-chamber training flights on the probability of developing bends in subsequent prolonged altitude exposures will be determined by use of the Doppler ultrasonic bubble detector. This newly developed device estimates the level of circulating bubbles which in turn estimates the probability that bends will occur. The shortest grounding time between training and mission flights which does not increase the likelihood of bends will be determined.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0026, ENHANCEMENT OF AIRCREW PERFORMANCE BY OPTICAL EQUIPMENT
T.J. TREDICI, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF321970)

Optical devices have the potential to enhance flight crew performance and/or facilitate inflight procedures. In order to insure that AF aircrew are provided with optical aids which can optimize their performance, development and testing of visual devices will be on a continuous basis.

The USAFSAM will respond to operational problems identified from the field for development assistance and/or in planned research efforts where a long-standing need may exist. Filter enhancement for target detection, multifocals designed specifically for cockpit use, and new spectacle frame developments in new plastic materials will be studied. Efforts under this work unit were previously documented as work unit 7755-09-03.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0027, CLINICAL LABORATORY TECHNIQUES
D.F. WEASE, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF321750)

Because routine clinical laboratory techniques were designed for hospitals, these existing techniques will be modified to increase their precision and accuracy. This will improve the ability of these tests to discriminate between healthy aircrew members and those with an early illness. To develop new techniques in the measurement of clinical parameters in laboratory medicine with emphasis on specificity, accuracy and precision. To develop sensitive methods of quality control of laboratory measurements to detect slight shifts of laboratory accuracy and precision as early as possible. To redefine the normal ranges of laboratory values for USAF aircrew personnel based on the more precise and accurate techniques. This will improve the selection criteria of USAF aircrew and enable flight medical personnel to intervene at an early stage in an illness of an aircrew member.

Modify existing techniques and equipment and/or develop new techniques and equipment to increase the specificity, accuracy, and precision of the measurements. Develop more reliable methods for the evaluation of the new techniques to define the accuracy, specificity, and precision, and to manage the long-term quality control for routine operation. Analyze laboratory data obtained by new techniques to define more accurate normal ranges for USAF aircrew personnel. Progress under this work unit was previously documented under 7755-05-07.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, AEROELASTIC OPTIMIZATION WITH MULTIPLE CONSTRAINTS
S.C. MCINTOSH, Nielsen Engin. & Research Inc., *Mountain View, California* 94040 (DF047500; F49620-77-C-0055)

AF function - advanced flight vehicle structures of lighter weight and increased durability will be necessary to achieve future Air Force mission requirements. Deficiency - current aerospace vehicle designs do not reflect consistent consideration of disciplines influencing structural designs. Objective - objective of this research program is to investigate structural optimization techniques applicable to multiple constraint conditions representative of aerospace vehicles. How work contributes - this effort is part of a program to develop the basic capability required to achieve optimal structural design in the Air Force.

Research program will investigate the efficiency and accuracy of basic solution algorithms for minimum weight structural designs. Primary attention will be given to math programming (MP) and optimality criteria (OC) algorithms involving flutter speed and vibrational constraints. Fixed and variable mode coordinate will be used in examining convergence to flutter speed and computational efficiency.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0002, MATHEMATICAL EVALUATION AND REVIEWING SERVICES
T.A. BOTTS, Conf. Board of The Math. Sci., *Washington, District of Columbia* 20037 (DF029640; F44620-70-C-0062)

The AFOSR is assigned the mission of supporting programs of research in universities and industry designed to provide new scientific knowledge and understanding in those areas of science which offer the greatest potential for improving the Air Force's present and future operational capability. Research in the critical areas of information sciences, control theory, and probability and statistics under project 9769 and in the equally critical areas of physical mathematics, numerical analysis, and system science under project 9749 is the specific responsibility of AFOSR's Directorate of Mathematical and Information Sciences. This work unit provides that directorate with in-depth and expert scientific evaluation of proposals and related advisory services, thereby insuring support only of those research programs of the highest scientific quality. These services coupled with the scientific and relevancy assessments made by the AFOSR program managers for these areas and the frequent assistance of selected Air Force laboratory personnel make up a meaningful and balanced work unit selection procedure in the mathematical and information sciences which enhances the overall contribution made by AFSOR in advancing the technology base on which the effective and efficient planning, RDT&E, and operation of aerospace systems depend.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0003, KINETIC THEORY OF GASES AND MAGNETOFLUID DYNAMICS AND THEIR APPLICATIONS
H. GRAD, New York University, School of Arts & Sciences, *New York, New York* 10012 (DF041250; AF-AFOSR-2881-76)

AF function - hardening aerospace vehicles. Opportunity - existing mathematical physics promises improved understanding of satellite environmental effects and their simulation. Objective - to address plasma stability problems in shiva, laser hardening, solar wind prediction, satellite charge oscillations, ionospheric modeling, etc. How work contributes - improved analysis of models designed to exhibit AF relevant effects may suggest methods of control.

At the borderline between particle and fluid, when charge, EM field and energy range combine to make nonlinear mathematical models necessary, a diversity of mathematical techniques is required. Examples are signular perturbation of spectra, bifurcation theory, pseudo-differential operators, solitions, etc. Using these techniques, problems such as the instabilities possibly limiting shiva X-ray output, solar wind modeling and laser target interactions can be addressed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0004, COMPUTER GRAPHICS RESEARCH
C.A. CSURI, Ohio State University, School of Arts & Sciences, *Columbus, Ohio* 43210 (DF140520; AF-AFOSR-3346-77)

The use of finite-element methods for design of structural components contributes significantly to the effectiveness and efficiency of flight vehicles. Staging (structural analysis via generalized interactive graphics) is being developed to assist in using the finite-element programs more effectively. There is a need to explore new graphic techniques to support the staging effort. The objective of this effort is to investigate incorporating advanced computer graphics concepts into staging.

A preliminary investigation has revealed that significant advances have been made in model generation, languages to easily define spacio-temporal models, hidden line removal, and dynamic picture processing. The approach is to further evaluate these capabilities to determine their impact on staging, accelerate the development of the most promising areas, and begin the transition of capabilities into staging.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

7.0005, IAP SURFACE GEOMETRY GENERATION
T. BALDWIN, Atlantic Research Corporation, *Alexandria, Virginia* 22314 (DF737690; F30602-77-C-0126)

The objective of this effort is to develop the algorithms and computer codes to generate within the computer the description of a given geometrical surface to be used as an input for the RADC electromagnetic compatibility analysis codes. Examples of such surfaces include aircraft fuselages, wings and ground-based antenna towers.

The contractor will determine the geometry inputs required by the analysis codes now existing or planned within the framework of the intrasystem compatibility analysis program (ICAP), such as the intrasystem electromagnetic compatibility analysis program (IEMCAP) and the general electromagnetic model for the analysis of complex systems (GEMACS). Based on the requirements determined from this evaluation the contractor will develop the algorithms and a computer code for a geometry generation module (GGM) that shall interface with the ICAP codes. This will enable the user to enter a physical description of the system geometry into the required solution technique to the degree of accuracy required. Candidate techniques that can be used to generate the surface geometry include generic elements (cylinders, cones, spheres, etc.) and spline function descriptors. The end item is a computer code and its documentation which can be used in a stand-alone mode or in concert with ICAP codes to mathematically model a physical system as a combination of surfaces.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, EXPERIMENTAL AND THEORETICAL STUDY OF V-VI-VII COMPOUNDS
C.Y. FONG, Univ. of California, School of Letters & Science, *Davis, California* 95616 (DF049470; AF-AFOSR-3390-77)

AF function - microwave electronic devices are important elements of Air Force communications and countermeasures systems. Opportunity -improved performance can be expected from the use of new solid-state materials for the generation and detection of microwave signals. Present microwave solid-state device performance is limited by the properties associated with the structure of the device material. Objective - the objective of this research program is to determine if the electronic band structure of these materials exhibits sufficiently interesting negative mass states to warrant further investigations of electron transport properties to ascertain their potential for utilization in solid-state microwave amplifiers and generators. How work contributes - these compounds belong to a class of group V-VI-VII compounds that have a number of interesting physical properties possibly including negative mass charge carriers suggesting potential technological utility, especially for microwave devices. It is anticipated that each of these semiconductors (listed below) have negative mass charge carriers.

This research investigated experimentally and theoretically the electronic band structure of the semiconductors BiScl, BiSi and BiSel.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0002, MICROSCOPIC STUDY OF LOW-LYING EXCITATIONS IN SUPERFLUID 3HE AND SUPERCONDUCTORS
K. MAKI, Univ. of Southern California, School of Letters Arts & Sci., *Los Angeles, California* 90007 (DMR76-21032 A01)

This is a continuation and extension of research started under NSF grant DMR74-23429. The basic thrust is to study the theory of dynamical properties of superfluid 3He and superconductors from a completely microscopic point of view. Specific problems under study are: 1.) Nonlinear Dynamics of Superfluid 3He - The basic equation governing the spin motion in superfluid 3He-A and B in the absence of dissipation has been derived. Explicit solutions of physical relevance remain to be found. 2.) Dissipation Phenomena in Superfluid 3He - A formulation of the transport coefficients in superfluid 3He-B has been developed. Of further interest is the effect of dissipative terms on the nonlinear spin-orbital dynamics of superfluid 3He. 3.) Surface Phenomena in Superfluid 3He - The magnetic coupling as well as the acoustic coupling between liquid 3He and magnetic or nonmagnetic substance will be studied. 4.) Low-Lying Excitations in Superconductors - Of particular interest are the fluctuation of the order parameter in the clean type II superconductor, and that in the type I superconductor far below the transition temperature. 5.) Dynamics of Superconductors with Periodic Substructures - The interaction between the periodic substructure and the vortex lattice will be examined and the effect of periodicity on the basic superconducting properties will be studied.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0003, INVESTIGATION OF ELECTRON ATTACHMENT PROCESSES IN POLYATOMIC MOLECULES
J.T. DOWELL, Internat. Res. & Tech. Corp., *San Diego, California* 92138 (DF047890; F49620-77-C-0071)

AF function - weapon system survivability, detection. Deficiency -there is presently insufficient knowledge of the complex interactions between electrons and molecules in a reentry vehicle flow field, especially the mechanism and rates of electron attachment. Objective -investigation of the low-energy electron attachment processes in polyatomic molecules with emphasis on the study of labile species produced in molecular beams. How work contributes - chemical processes leading to the production and removal of electrons in the reentry vehicle wake are important in determining the plasma conductivity and in the consideration of the radar signature. This research seeks understanding and knowledge of electron removal processes by electrophilic molecules.

Conventional monoenergetic electron beam techniques are to be used for measurement of electron energy dependencies of attachment cross sections and of resonance, but a new method, incorporating a quadrupole electron trap, will be developed for determination of attachment rates as functions of temperature from 300K to 3000K. Species to be investigated include the metal oxyacids, beginning with tungstic acid. A study of the problem of electron bound states in the dipole fields of polar molecules will be initiated through measurements on the alkali halides. The mass spectrometric study of the WO3(S) H2O reaction in the temperature range 1100K to 1600K will also serve as a check of the Janaf thermochemical data for H2WO4, WO3 and the polymers of WO3. The gas temperature dependence of the attachment will be studied separately from the electron energy dependence to assess the role of internal excitation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0004, PLASMA WAVE TURBULENCE AND HEATING BY ELECTRON BEAMS, RADIATION AND PINCHES
M.V. GOLDMAN, Univ. of Colorado, School of Arts & Sciences, *Boulder, Colorado* 80302 (DF035410; F49620-76-C-0005)

AF function - operation of high-altitude vehicles in a post-nuclear explosion environment, development of electromagnetic weapons, space and ionospheric communications as well as countermeasures demand fundamental understanding of the process of plasma wave turbulence and heating by electron beams, radiation and pinches. Deficiency - the aforementioned information required to design advanced equipment is not available today. Its acquisition may be realized by both experimental and theoretical research. Objective - this project will investigate the fundamentals of Langmuir plasma turbulence excited by electron beams (and to a lesser extent, laser beams), including wave-particle interactions. It will provide theoretical support for experiments on the Culham plasma focus device to probe both laser-induced and current-driven plasma turbulence. It will also develop a theory of high beta pinches. Contributions - this work is a part of a comprehensive program of plasma research for the development of an X-ray radiation source for simulation of nuclear weapon effects, the development of advanced electromagnetic weapons (laser and particle beam), the development of space and ionospheric communications, and the development of countermeasures.

This project will perform theoretical work directed toward understanding of Langmuir plasma turbulence excited by electron (and laser) beams including wave-particle interactions. It will examine the case of Langmuir plasma turbulence excited by a warm electron beam in a plasma of equal ion and electron temperature. It will specifically study (a) three-dimensional nonlinear wave-wave interactions, (b) quasilinear theory and (c) the effects of a guiding magnetic field. It will also examine the case of Langmuir plasma turbulence excited by an electron beam when the plasma electron temperature is much larger than the ion temperature. It will examine the coupling of beam-excited Langmuir plasma turbulence to the background plasma particles. It will specifically study (a) the main body electron heating, (b) the electron tails, and (c) the ion acceleration. It will examine Langmuir plasma turbulence excited by a laser beam and will develop a statistical theory of coherent nonlinear Langmuir plasma waves excited by laser and particle beams. It will develop a theory of high beta pinches. (Text abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0005, SURVEILLANCE - HIGH-POWER MAGNETOSTRICTIVE RARE EARTH TRANSITION METAL SYSTEMS
E. CALLEN, Amer. University, School of Arts & Sciences, *Washington, District of Columbia* 20016 (DN123164; N00014-75-C-0736)

This research has as its objective the development of new magnetic materials useful to the Navy in its surveillance operations as improved acoustic transducers, in control devices and in electronic circuits employing piezoelectric and magnetostrictive effects and in electronic devices utilizing permanent magnets.

An experimental and theoretical study will be made of various materials such as the rare-earth alloys, intermetallic compounds, polyphase suspensions and sintered mixtures to determine their physical properties that influence the parameters suitable for yielding large magnetostriction while preserving good conductivity and structural properties for transducer application. The materials will be prepared and checked for their magnetic properties by Mossbauer analysis, by strain gauges, by conventional torque and direct movement measurements.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0006, NEUTRON DIFFRACTION CRYSTAL AND MOLECULAR STRUCTURE STUDIES
J.M. WILLIAMS, Argonne National Laboratory, *Argonne, Illinois* 60439 (CHE76-07409 A01)

Neutron diffraction analysis of various crystal structures is to be carried out at Argonne National Laboratory for projects in a variety of chemical areas. Research topics supported include the study of charge densities in solids for both small and large molecules and for hydrogen-bonded systems, study of hydrogen atom locations in pyrazolylborate and acetylene complexes, bonding of hydrogen with transition metals and determination of the distribution of unpaired electrons in metal cluster systems, location of bridging hydrogens in covalent metal tetrahydroborates, structure of metal cluster hydrides containing phosphite groups, investigation of molecular dynamics of tetraphenylporphyrin derivatives in the solid state, and study of metal-exchanged zeolites and hydrocarbons absorbed on active zeolite sites. Other subjects to be included to the extent that resources permit are studies of nucleosides and nucleotides, of linear chain metals derived from mercury salts, of electron distribution in nitrogen compounds, of the structural basis for phase transitions, conductivity, and magnetism, of X-ray induced crystal decomposition, and of location of hydrogen atoms in osmium cluster compounds.

This research is a continuation of that currently supported by Foundation Grant, CHE-7607409.

SUPPORTED BY U.S. National Science Foundation, Div. of Chemistry

8.0007, RELATIVISTIC AND EXCHANGE EFFECTS IN NONMETALLIC COMPOUNDS
D.E. ELLIS, Northwestern University, School of Arts & Sciences, *Evanston, Illinois* 60201 (DMR77-22646)

The relativistic Dirac-Slater one-electron theory will be generalized to include exchange polarization of open shell systems in a self-consistent framework. This theory will provide a simple unified treatment of spin-orbit and orbital polarization effects. Computational methods, which have been developed for atoms and molecules, will be applied to study the energy levels, charge and magnetization densities for nonmetallic compounds of the heavy transition metals and rare earths. The theoretical results will be compared with Mossbauer isomer shift and hyperfine data, photoelectron spectra, and neutron magnetic form factors.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0008, RESEARCH ON TERRESTRIAL GENERAL RELATIVITY EFFECTS USING ATOMIC CLOCKS AND AIRCRAFT
C.O. ALLEY, Univ. of Maryland, School of Arts & Sciences, *College Park, Maryland* 20742 (DF048090; AF-AFOSR-3268-77)

AF function - the AF has the responsibility of providing highly accurate time and frequency standards for use in high-precision navigation systems such as the global positioning system. Deficiency -methods for correcting for gravitational potential effects on measured time rates have not been properly incorporated into advanced navigational systems. Objective - the objective of this program is to clarify the effects of gravitational potential upon measured time rates as predicted by general relativity. The specific areas to be investigated are (1) the effect of latitude on clock rates, (2) the effect of the gravitational potential of the sun on clock rates, and (3) an accurate measurement of the effect of earth rotation on time. Contribution - this research will contribute to the development of highly accurate navigational systems for aircraft and missile use.

The existence of commercially available cesium atomic clocks, which exhibit stabilities of 2×10^{-14} per day when their environment is suitably controlled, allows significant measurements to be made in a terrestrial environment of the general relativistic effects on time. Of major interest, is an investigation of the rate of clocks placed at different latitudes. General relativity predicts that the change in velocity due to earth rotation in going from the equator to the pole is just compensated by the change in gravitational potential along the geoid. Comparison of clocks that have been at different latitudes (with proper correction for the effect of transporting them) will provide an interesting null experiment. Of next interest is an investigation of the rate of clocks at different latitudes on the earth as they are affected by the gravitational potential of the sun. At the time of the solsticies, 22 December and 22 June, the axis is tilted 23.5 degrees away from or toward the sun, resulting in different average solar gravitational potentials at different latitudes. General relativity predicts that the clock rate difference expected from the solar potential difference is cancelled by orbital velocity differences.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0009, EXPERIMENTAL STUDIES OF ION CHARGE AND ION FLUX IN STREAMING PLASMAS
D.W. KOOPMAN, Univ. of Maryland, Inst. for Fluid Dyn. & Math., *College Park, Maryland* 20742 (DF033820; AF-AFOSR-2991-76)

AF function - considerable damage and incapacitation of equipment may result from laser irradiation and from a nuclear detonation. These deleterious effects may be drastically decreased and even eliminated by suitable design. Deficiency - the design characteristics of protection devices are not well known. In the case of nuclear detonations the SALT agreements prohibit nuclear testing; consequently, the required data can be obtained only by simulation techniques. Objective - this research will study highly ionized plasma flows produced by laser irradiation of target materials and the interaction of these plasmas with neutral and ionized backgrounds. Three objectives may be mentioned: (a) collisional momentum transfer, (b) magnetized plasma interactions including the production of experimental data describing the expansion processes in the laser-produced plasmas, (c) comparison of the experimental and theoretical results as well as predictions, yielding improved understanding of the plasma flow dynamics. Contribution - this research is a part of a comprehensive program for the development of an X-radiation source for simulation of nuclear weapon effects, the development of advanced electromagnetic weapons (laser and particle beam), the development of space and ionospheric communications, and countermeasures.

This research is both theoretical and experimental, and it will investigate and elucidate the dynamics of flowing and interacting plasmas and gases with an emphasis on the processes which transfer momentum between ion species within the flow. It will perform measurements employing the resonant optical diagnostic technique developed last year, with an extension to holographic as well as Schlieren and absorption recording of plasma flow patterns. In addition, it will investigate the recently discovered turbulent interaction region which is responsible for the development of shocklike momentum coupling fronts. The existing installation will be modified in such a way as to add a variable magnetic field to the plasma flow region. It will thus examine flow regimes which are collisionless and will attempt to verify the mechanisms of two-stream instability which have been predicted by the theory.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0010, DEVIATIONS FROM MATTHIESSEN'S RULE IN THE ELECTRICAL RESISTIVITY AND ATTENDANT EFFECTS IN OTHER TRANSPORT PROPERTIES (ABBREV)
R.I. BOUGHTON, Northeastern University, School of Liberal Arts, *Boston, Massachusetts* 02115 (DMR77-24023)

This is a continuation of the research previously supported by DMR-7513090.

The experimental research program consists of two parts. The first and major portion involves a series of measurements of the electrical resistivity in a specific group of polyvalent metals which exhibit large and systematic deviations from Matthiessen's rule which are not at present adequately described by theory. Definitive experimental tests of the 'Non-conservation of Momentum' theory will be carried out by studying the correlations between impurity scattering-induced deviations in the electrical resistivity with boundary scattering-induced deviations and deviations in the thermal resistivity, respectively. The second part of the research program entails a continuation of the investigation of the possibility of observing flux quantization in a normal metal through measurement of the Aharonov-Bohm effect.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0011, HIGH-ENERGY PLASMA ANALYSIS
B.F. SELLERS, Panametrics Incorporated, *Waltham, Massachusetts* 02154 (DF249030; F19628-77-C-0137)

AF function - communications and reconnaissance. Deficiency -anomalous behavior of high-altitude satellites. Research - calibrate, integrate and evaluate instrumentation to measure electron and proton fluxes in .05 - 500 keV energy range. How research contributes - this analysis will be of an instrument used in the SCATHA satellite as one of a number of sensors intended to define the particle and field environment at synchronous orbit and its effect on satellite performance. It involves the integration, calibration and testing of SCATHA satellite instruments, the in-orbit operation, and the evaluation and analysis of research data from this instrument. These data will further the understanding of the synchronous orbit plasma and the causes of spacecraft charging.

This contract will provide for the integration, calibration, evaluation, and data analysis of a high-time-resolution particle spectrometer aboard the SCATHA satellite. By defining on a rapid time basis the influx of energetic plasma to the SCATHA satellite, the build-up of potential and charge aboard a synchronous orbit satellite will be better understood. The in-orbit operation of the experiment, in coordination with other SCATHA instruments, will relate cause and effect in spacecraft charging and help to provide design criteria so that future space systems will be resistant to spacecraft charging.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

8.0012, POSITRON INTERACTIONS WITH ATOMS AND MOLECULES
W.E. KAUPPILA, Wayne State University, School of Liberal Arts, *Detroit, Michigan* 48202 (PHY77-18760)

A low-energy and highly monochromatic positron beam has been developed and used to initiate a complementary program of research involving the collisions of positrons with atoms and molecules.

The present measurements will be continued with increasing emphasis being placed on investigations of possible structural features in total scattering cross sections, such as Ramsauer-Townsend effects, resonances, and behavior near inelastic thresholds. The program will also be expanded into new areas of positron research, including positron collisions with atomic hydrogen and alkali atoms, and differential scattering of positrons. Comparison measurements between positrons and electrons in the same apparatus are an important part of this research program.

This work is a continuation of that currently supported under NSF grant number PHY75-07165 A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0013, SURVEILLANCE--ELECTRONIC AND MAGNETIC PROPERTIES OF MATERIALS FOR CRYOGENIC DEVICES
A.M. GOLDMAN, Univ. of Minnesota, School of Liberal Arts, *Minneapolis, Minnesota* 55455 (DN123311; N00014-76-C-1086)

The objective of this task is to study the electronic and magnetic properties of superconducting materials for use in surveillance and communication devices. Techniques for cooling systems to millidegree temperatures are being developed.

This task comprises a variety of experimental investigations in the areas of cryogenics, low-temperature physics, and solid-state physics. They include: studies of the effect of thermal fluctuations on the Josephson current; susceptibility measurements of superconductors using Josephson current probes; susceptibility measurements of crystalline He-3; nuclear magnetic resonance and nuclear orientation studies of magnetic phase transitions and hyperfine interactions in metals and the development of millidegree cooling techniques.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0014, MICROWAVE REFLECTIONS FROM VIBRATING INHOMOGENEOUS CONDUCTING SURFACES

H.J. JURETSCHKE, Polytechnic Inst. of New York, School of Science & Engin., *Brooklyn, New York* 11201 (DF043910; AF-AFOSR-3030e76)

AF function - identification and recognition of targets under all-weather and night conditions. Deficiency - effectiveness of strike capability is diminished by unreliable selection of moving targets. Objective - features of a target have to be determined and utilized which allow with high probability a unique and environment-independent identification. This research relates to the identification of moving vehicles on the basis of their radar backscatter characteristics which are caused by vibration of junctions of abutting metal parts, that is, to the problem of RADAM (radar detection of agitated metals). How work contributes - experimental and theoretical study of backscattering from time variant metal-insulator-metal junctions.

The study of microwave properties of composite conducting surfaces such as represented by grainy oxide layers of iron or oxide layers in surface fissures as a model for the modulation of electromagnetic signals scattered from vibrating metallic surfaces will be continued. The work will concentrate on (a) the microwave response of surfaces prepared under controlled conditions and of surfaces aged in natural environments, (b) the strain-sensitive electrical properties of thin layers that simulate on a macroscopic level the effect of junctions between metallic layers, (c) the development of a model of the electrical properties of such composite surfaces that permits predictions of the effect of changing frequency, clean surface substrate, and surface conditions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0015, LASER LIGHT SCATTERING STUDIES OF SOLIDS

H.Z. CUMMINS, City University of New York, School of Arts & Sciences, *New York, New York* 10031 (DMR77-23788)

This research was previously supported by DMR-7412040.

The recently discovered dynamical central peak in potassium dihydrogen phosphate will be investigated using ultrahigh-resolution interferometry. Both the dynamic and static central peaks will be investigated in doped crystals and neutron irradiated crystals in order to establish the importance of impurities and defects to both central peaks. Additional experiments will be performed under hydrostatic stress in an effort to observe the theoretically predicted critical narrowing of the central peak.

Forbidden Raman scattering in cuprous oxide will be continued with the addition of uniaxial stress in order to elucidate the classification of the exciton series and of the interactions responsible for the unobserved excited-state resonances.

Resonance Brillouin, reflectance and luminescence studies of cadmium sulfide will be completed, and possible new experiments will be explored including the melting transition and superionic conductors.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0016, STUDIES OF MAGNETIC FLUX AND CRITICAL CURRENT DISTRIBUTION NEAR THE SURFACE IN TYPE II SUPERCONDUCTORS

R.W. ROLLINS, Ohio University, School of Arts & Sciences, *Athens, Ohio* 45701 (DF040610; AF-AFOSR-2807-75)

AF function - the proposed research primarily falls in the 5.3 research objectives which deal with electrical power from non-nuclear energy sources. In particular, the development of a superconductive rotating electrical power generators and pulsed superconductive energy storage systems requires basic understanding of magnetic flux motion and associated losses in type II superconductors. Knowledge of magnetic flux pinning sites and their influence on losses is needed. Deficiency -losses incurred during AC operation are one of the major problems encountered in the development of AF high-power superconducting devices. Such AC power losses often arise entirely from a small region near the surface of the superconducting material where local inhomogeneities give rise to pinning of the magnetic flux. Objective - the objective of this research is to develop an understanding of pinning mechanisms and surface preparation together with their effect on the magnetic flux distributions near the surface preparation together with their effect on the magnetic flux distributions near the surface of a superconductor. Specifically, critical currents and flux pinning due to defects produced by bombardment of ions of controlled energy will be studied. How work contributes - this research is a part of a comprehensive program in superfluids and superconductors.

It is planned to continue according to the proposal studying the effect of proton irradiation on pure Nb, Nb-Ta and Nb-Ti alloys including in particular the relationship between the superconducting properties and flux pinning and (1) the total proton fluence, (2) the effect of low-temperature anneals (100-800 degrees C) on the irradiated samples, (3) the energy of the incident protons. Measurements of the flux pinning force, FV, will be made as a function of magnetic field and temperature. The behavior of the peak observed in FV for irradiated NB will be carefully studied and similar peaks which may occur in irradiated Nb alloys will be looked for. Recent work strongly suggests that the defects responsible for the flux pinning in room-temperature neutron irradiated Nb are dislocation loops. Similar defects are expected to be formed by proton irradiation. Comparing neutron and proton irradiation for the same energy and dose, protons are from 10-1000 times more effective in producing displaced atoms which lead to the dislocation loops. (Text abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0017, RAMAN SPECTROSCOPY OF SOLIDS 14332-P

E. BURSTEIN, Univ. of Pennsylvania, School of Arts & Sciences, *Philadelphia, Pennsylvania* 19104 (DA0E9216; DAAG29 76 G0325)

To obtain theoretical and experimental information on the inelastic scattering of light by elementary excitations in solids. Relevance -the results of this research will improve the understanding of the interaction of light with surfaces of technologically important semiconductors and evolve new techniques for study of these interactions. The results hold promise for impacting the development of surface EM wave devices for optical signal processing.

The research will involve Raman scattering by optical phonons and polaritons in CuCl, resonance Raman scattering by phonons as a probe of the surface electronic structure of III-V compound semiconductors, the diffraction of volume EM waves by surface polaritons, and surface EM waves as the incident radiation in Raman scattering and other nonlinear optical phenomena.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Army Research Office

8.0018, DIRECT DOPING OF SEMICONDUCTORS

J.N. ZEMEL, Univ. of Pennsylvania, School of Engin. & Appl. Sci., *Philadelphia, Pennsylvania* 19104 (DF049850; AF-AFOSR-3432-77)

AF function - microwave solid-state devices are essential elements of Air Force communications, reconnaissance, surveillance and countermeasure systems. Opportunity - as electronic devices become smaller and smaller, new technologies in device pattern generation will be required. Objective - it is the objective of this research to contribute to the development of submicron pattern generation. How work contributes - this work could lead to a simplified process for planar device fabrications.

As-S and As-Te-S-Ge chalcogenide amorphous films, which have differential chemical etching rates upon exposure to light, will be used as resists to establish patterns of these materials on the region of substrates or epitaxial films of Si and GaAs to be doped. After encapsulations, doping will be achieved by diffusing the unetched resist into the Si or GaAs to make devices.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0019, VISCOSITY MEASUREMENT IN LIQUID CRYSTALS
S.V. LETCHER, Univ. of Rhode Island, School of Arts & Sciences, *Wakefield, Rhode Island* 02881 (DMR77-07813)

Viscosity measurements of liquid crystalline phases, using for the most part a rectangular-capillary viscometer in a high magnetic field, are continued. For the nematic phase, previous viscosity measurements with different techniques have provided inconsistent results, probably due to defects in the nematic structure. The reasons for the discrepancies are being investigated. For the smectic and cholesteric phases, high magnetic fields--higher than those obtainable with standard electromagnets--are required to maintain molecule orientation during flow. Experiments using smaller fields or surface alignment can probe only narrow regimes of temperature and flow rate. The present high field experiments are uniquely able to probe the dynamic properties of these phases.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0020, MAGNETIC PHASE TRANSITIONS AND GROUND STATE PROPERTIES OF MAGNETIC CRYSTALS
J.L. FRY, Univ. of Texas, Graduate School, *Arlington, Texas* 76010 (DF043370; AF-AFOSR-2981-76)

AF function - this proposed research primarily falls in the 7.4 research objectives which deal with the theoretical and experimental investigations of electronic, optical, acoustic, thermal, magnetic, and conducting properties of materials to evolve new and improved device concepts. In particular, the theoretical investigations of the magnetic phase transitions will be done to give a deeper understanding of the physics of magnetic properties in itinerant electron systems. The gaining of this understanding of the precise mechanisms involved lead to meaningful mathematical models which in turn form a more rational and less empirical device design. Deficiency - a wide range of basic research efforts that support the development of devices and device concepts is needed for the application of contemporary electronic electromagnetic technology in the operational Air Force. Most studies of magnetic properties utilize model Hamiltonians, and model potentials which leave a large amount of uncertainties. Objective - the objective of this research is to perform first-principles energy band calculations using the Hartree-Fock method, which treats the exchange interaction exactly. Next, include correlations with an acceptable approximation to derive the general properties of magnetic crystals, namely the magnetic susceptibilities and study magnetic phase transitions. How work contributes - this research is a part of a comprehensive program in statistical mechanics to study phase transitions.

The work proposed consists of four distinct phases. The first phase will require extension of current Hartree-Fock capabilities for solids to treat d-electron atoms and will include as test cases studies of certain non-magnetic crystals as well as magnetic crystals of interest in this proposal. Ground-state properties will be computed from Hartree-Fock results and excitation energies will be obtained by making correlation corrections using, for example, the screened exchange plus Coulomb hole formalism. The second phase of this work will consist of unrestricted Hartree-Fock calculations for ferromagnetic and antiferromagnetic metals. Quantities to be obtained include density of states, magnetic and X-ray form factors, Compton profiles, optical conductivity, spin splittings and spin-wave effective masses. (Text abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, PROPOSAL TO STUDY PREFLARE MAGNETIC FIELD CONFIGURATIONS
S.S. MARTIN, Calif. State Univ. & Colleges, Graduate School, *Northridge, California* 91326 (DF044490; AF-AFOSR-3068-76)

AF function - this research will contribute to the existing Air Force requirement for the capability to predict solar flares. Deficiency - in spite of many years of research into the cause of solar flares and the source of their energy, there is still no definite explanation of the physical processes involved in these events. Objective - this research will involve a study of a particular subset of flares, i.e., those occurring between adjacent active regions. The logic behind this is that studying a smaller group will reduce the number of variables necessary to quantify the physical parameters in flares. Contribution - success in this research could lead to an understanding of the physical mechanisms involved in initiating and providing the driving energy in a particular type of flare which in turn could lead to a general understanding.

This study will involve an observational and theoretical study of the subset of flares which occur at the boundaries between adjacent active regions. This subset of flares is chosen because it offers the unique possibility of observationally defining conditions when flares will definitely not occur between initially separate active regions versus conditions when the occurrence of flares is highly probable at these same locations. Theoretical study of this same subset of flares also is attractive because these flares can occur when the adjacent active regions have simple bipolar magnetic field configurations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

10.0002, SOLAR FLARES
H. ZIRIN, Calif. Inst. of Technology, Graduate School, *Pasadena, California* 91109 (DF248780; F19628-77-C-0106)

AF function - communications, surveillance, detection, tracking. Deficiency - inadequate warnings of sun-induced disruptions. Objective - determine the effect of chromospheric structures, motions and magnetic fields on the solar atmosphere and how each contributes to the environment for solar activity. How research contributes - provides the physical knowledge necessary for a sound cause-and-effect prediction technique for solar-induced disruptions.

Collaborative studies with the Sacramento Peak Observatory on the chromosphere to obtain maximum observational data on selected solar events.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

10.0003, GALACTIC EVOLUTION AND RELATED STUDIES
B.M. TINSLEY, Yale University, Graduate School, *New Haven, Connecticut* 06520 (AST77-23566)

Theoretical research on the evolution of galaxies and related topics will be carried out. The major projects are studies of field galaxies as probes in cosmology, rates of star formation in normal and peculiar galaxies, and nucleochronologies as constraints on chemical evolution in the solar neighborhood. Specific projects will include a study of chemical evolution in collapse models for the formation of disk galaxies and detailed population models for elliptical galaxies. An analysis of the Hubble diagram and related cosmological parameters will be done taking into account recent theories of galactic evolution. Previous results will be extended in the context of new data and related theories.

This research is a continuation of grant AST 75-16329 AO1.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0004, X-RAY ENVIRONMENTAL LIMITS TO MILITARY SYSTEMS - SOFT X-RAY ASTRONOMY
G.G. FRITZ, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN480098)

Develop and fly advanced sensors to determine the X-ray background above the earth's atmosphere (which limits the sensitivity of X-ray detonation). Evaluate the effect of such background limitations for defense surveillance and for auroral monitoring intended for communication disturbance prediction. Determine the temporal, spatial and spectral variability of the background X-ray sources from such studies.

X-rays from space in the energy range 0.1 to 20 keV are measured with detectors carried on sounding rockets and satellites. Results from these observations of both compact and extended sources of X-rays are analyzed. X-ray spectra and X-ray sky maps are compared with theoretical calculations.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

10.0005, THE CHROMOSPHERES AND CIRCUMSTELLAR ENVELOPES OF RED GIANT STARS

A.M. BOESGAARD, Univ. of Hawaii, School of Arts & Sciences, *Honolulu, Hawaii* 96822 (AST76-81608 A01)

Two projects will be carried out in order to determine the nature of the physical conditions in circumstellar envelopes of stars. There will be a study of the ultraviolet emission lines of singly ionized iron in red M stars. The details of these line profiles in two M giants with similar surface temperatures but different iron line emission intensities will help in understanding the processes of formation of circumstellar envelopes in red giant stars. A computer program will model the emission features, and comparison of the predicted and observed emission lines will enable characteristics such as the temperature-density distributions and mass motions in the gas to be determined. A study will be made of the circumstellar shells surrounding young T Tauri-type stars. The ultraviolet spectra of these stars are rich in emission features, and these include the same iron emission lines found in red giants. Information about the physical conditions in the envelopes and neubulosities surrounding these stars will be obtained by the same techniques used for the red giant stars. It is expected that the line profile analysis will enable one to distinguish between mass outflow and mass infall models for T Tauri stars.

This is a continuation of work previously supported under NSF grant AST76-81608.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0006, SURVEILLANCE - AMPLITUDE INTERFEROMETRY

D. CURRIE, Univ. of Maryland, School of Arts & Sciences, *College Park, Maryland* 20742 (DN475000; N00014-75-C-0343)

The objective of this project is to investigate the feasibility of using amplitude interferometry techniques for high-resolution surveillance of satellites and other objects in space. This will include demonstrations of high-resolution measurements through the turbulent atmosphere, measure various parameters of the atmosphere affecting the resolution and sensitivity of amplitude interferometer devices, upgrade existing equipment, and test this equipment on the AMOS telescope. This is important to Navy programs in star position mapping.

The University of Maryland array photometer having single photon counting sensitivity will undergo further testing and then be installed in the multi-aperture amplitude interferometer. An upgraded pointer and tracker will be installed and tested on the multi-aperture amplitude interferometer. The entire multi-aperture amplitude interferometer device will be subjected to environmental tests prior to demonstration tests which will be conducted at the AMOS facility at Mt. Haleakala where performance of the multi-aperture amplitude interferometer will be evaluated in at least two test periods. The objective of these tests will be to fully demonstrate and verify the operational characteristics of the multi-aperture amplitude interferometer.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

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Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N78-17989* + National Aeronautics and Space Administration, Washington, D. C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 91, JANUARY 1978
Jan. 1978 106 p
(NASA-SP-7037(91)) Avail: NTIS HC E02 CSCL 01A

This bibliography lists 359 reports, articles, and other documents introduced into the NASA scientific and technical information system in December 1977. Author

N78-17990*# Boeing Vertol Co., Philadelphia, Pa.
RESEARCH REQUIREMENTS TO REDUCE MAINTENANCE COSTS OF CIVIL HELICOPTERS
Daniel J. Million and Kenneth T. Waters Feb. 1978 62 p refs
(Contract NAS1-13624)
(NASA-CR-145288) Avail: NTIS HC A04/MF A01 CSCL 01C

The maintenance problems faced by the operators of civil helicopters that result in high costs are documented. Existing technology that can be applied to reduce maintenance costs and research that should be carried out were identified. Good design practice and application of existing technology were described as having a significant impact on reducing maintenance costs immediately. The research and development that have potential for long range reduction of maintenance costs are presented. Author

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

N78-17991*# Pratt and Whitney Aircraft, East Hartford, Conn. Commercial Products Div.
MEAN VELOCITY, TURBULENCE INTENSITY AND TURBULENCE CONVECTION VELOCITY MEASUREMENTS FOR A CONVERGENT NOZZLE IN A FREE JET WIND TUNNEL COMPREHENSIVE DATA REPORT
C. J. McColgan and R. S. Larson Apr. 1977 262 p
(Contract NAS3-17866)
(NASA-CR-135238; PWA-5516) Avail: NTIS HC A12/MF A01 CSCL 01A

The effect of flight on the mean flow and turbulence properties of a 0.056m circular jet were determined in a free jet wind tunnel. The nozzle exit velocity was 122 m/sec, and the wind tunnel velocity was set at 0, 12, 37, and 61 m/sec. Measurements of flow properties including mean velocity, turbulence intensity and spectra, and eddy convection velocity were carried out using two linearized hot wire anemometers. This report contains the raw data and graphical presentations. The final technical report includes a description of the test facilities, test hardware, along with significant test results and conclusions. Author

N78-17992*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THEORETICAL EVALUATION OF HIGH SPEED AERODYNAMICS FOR ARROW WING CONFIGURATIONS
Samuel M. Dollyhigh Feb. 1978 66 p refs
(NASA-TM-78659) Avail: NTIS HC A04/MF A01 CSCL 01A

A limited study in the use of theoretical methods to calculate the high speed aerodynamics of arrow wing supersonic cruise configurations was conducted. The study consisted of correlations with existing wind tunnel data at Mach numbers from 0.8 to 2.7, using theoretical methods to extrapolate the wind tunnel data to full scale flight conditions, and presentation of a typical supersonic data package for an advanced supersonic transport application prepared using the theoretical methods. A brief description of the methods and their application was given. In general, all three methods had excellent correlation with wind tunnel data at supersonic speeds for drag and lift characteristics and fair to poor agreement with pitching moment characteristics. The VORLAX program had excellent correlation with wind tunnel data at subsonic speeds for lift and pitching moment characteristics and fair agreement in drag characteristics. Author

N78-17993*# Kansas Univ. Center for Research, Inc., Lawrence.
A THEORETICAL INVESTIGATION OF THE AERODYNAMICS OF LOW-ASPECT-RATIO WINGS WITH PARTIAL LEADING-EDGE SEPARATION
Sudhir Chandra Mehrotra and C. Edward Lan Jan. 1978 85 p refs
(Grant NsG-1046)
(NASA-CR-145304; CRINC-FRL-266-1) Avail: NTIS HC A05/MF A01 CSCL 01A

A numerical method is developed to predict distributed and total aerodynamic characteristics for low aspect-ratio wings with partial leading-edge separation. The flow is assumed to be steady and inviscid. The wing boundary condition is formulated by the quasi-vortex-lattice method. The leading-edge separated vortices are represented by discrete free vortex elements which are aligned with the local velocity vector at mid-points to satisfy the force free condition. The wake behind the trailing-edge is also force free. The flow tangency boundary condition is satisfied on the wing, including the leading- and trailing-edges. Comparison of the predicted results with complete leading-edge separation has shown reasonably good agreement. For cases with partial leading-edge separation, the lift is found to be highly nonlinear with angle of attack. Author

N78-17994*# Vought Corp., Hampton, Va. Technical Center.
A PROCEDURE FOR THE DETERMINATION OF THE EFFECT OF FUSELAGE NOSE BLUNTNESS ON THE WAVE DRAG OF SUPERSONIC CRUISE AIRCRAFT
Kenneth B. Walkley Jan. 1978 56 p refs
(Contract NAS1-13500)

(NASA-CR-145306) Avail: NTIS HC A04/MF A01 CSCL 01A

The incremental wave drag penalty due to nose blunting of a fuselage was investigated using a three dimensional finite difference scheme. An aircraft typical of current supersonic cruise concepts was considered. Computational problems with the finite difference scheme as the fuselage afterbody closes were addressed. A linear theory method was employed to compute the afterbody aerodynamics and effectively extends the finite difference scheme to closing afterbodies. Acceptable drag increments for various levels of nose bluntness were demonstrated using this approach. Author.

N78-17995*# Pennsylvania State Univ., University Park. Dept. of Aerospace Engineering.

COMPRESSOR AND FAN WAKE CHARACTERISTICS Semiannual Progress Report

B. Reynolds, C. Hah, B. Lakshminarayana, and A. Ravindranath Jan. 1978 104 p refs

(Grant NsG-3012)

(NASA-CR-155766; PSU/TURBO-R78-1) Avail: NTIS HC A06/MF A01 CSCL 01A

A triaxial probe and a rotating conventional probe, mounted on a traverse gear operated by two step motors were used to measure the mean velocities and turbulence quantities across a rotor wake at various radial locations and downstream stations. The data obtained was used in an analytical model developed to study how rotor flow and blade parameters and turbulence properties such as energy, velocity correlations, and length scale affect the rotor wake characteristics and its diffusion properties. The model includes three dimensional attributes, can be used in predicting the discrete as well as broadband noise generated in a fan rotor, as well as in evaluating the aerodynamic losses, efficiency and optimum spacing between a rotor and stator in turbomachinery. Author

N78-17996*# Polytechnic Inst. of New York. Aerodynamics Labs.

FILTERING OF NON-LINEAR INSTABILITIES

P. K. Khosla and S. G. Rubin Feb. 1978 33 p refs

(Grant NsG-1244)

(NASA-CR-155779; Poly-M/AE-78-6) Avail: NTIS HC A03/MF A01 CSCL 01A

For Courant numbers larger than one and cell Reynolds numbers larger than two, oscillations and in some cases instabilities are typically found with implicit numerical solutions of the fluid dynamics equations. This behavior has sometimes been associated with the loss of diagonal dominance of the coefficient matrix. It is shown that these problems can be related to the choice of the spatial differences, with the resulting instability related to aliasing or nonlinear interaction. Appropriate filtering can reduce the intensity of these oscillations and possibly eliminate the instability. These filtering procedures are equivalent to a weighted average of conservation and nonconservation differencing. The entire spectrum of filtered equations retains a three point character as well as second order spatial accuracy. Burger's equation was considered as a model. Author

N78-17997*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.

EFFECT OF WINGLETS ON A FIRST-GENERATION JET TRANSPORT WING. 4: STABILITY CHARACTERISTICS FOR A FULL-SPAN MODEL AT MACH 0.30

Robert R. Meyer, Jr. Feb. 1978 74 p refs

(NASA-TP-1119; L-11705) Avail: NTIS HC A04/MF A01 CSCL 01A

The static longitudinal and lateral directional characteristics of a 0.035 scale model of a first generation jet transport were obtained with and without upper winglets. The data were obtained for take off and landing configurations at a free stream Mach number of 0.30. The results generally indicated that upper winglets had favorable effects on the stability characteristics of the aircraft. Author

N78-17998*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECT OF DESIGN CHANGES ON AERODYNAMIC AND ACOUSTIC PERFORMANCE OF TRANSLATING-CENTERBODY SONIC INLETS

Brent A. Miller Feb. 1978 49 p refs

(NASA-TP-1132; E-9283) Avail: NTIS HC A03/MF A01 CSCL 01A

An experimental investigation was conducted to determine the effect of design changes on the aerodynamic and acoustic performance of translating centerbody sonic inlets. Scale model inlets were tested in the Lewis Research Center's V/STOL wind tunnel. The effects of centerbody position, entry lip contraction ratio, diffuser length, and diffuser area ratio on inlet total pressure recovery, distortion, and noise suppression were investigated at static conditions and at forward velocity and angle of attack. With the centerbody in the takeoff position (retracted), good aerodynamic and acoustic performance was attained at static conditions and at forward velocity. At 0 deg incidence angle with a sound pressure level reduction of 20 dB, the total pressure recovery was 0.986. Pressure recovery at 50 deg was 0.981. With the centerbody in the approach position (extended), diffuser flow separation occurred at an incidence angle of approximately 20 deg. However, good performance was attained at lower angles. With the centerbody in the takeoff position the ability of the inlet to tolerate high incidence angles was improved by increasing the lip contraction ratio. However, at static conditions with the centerbody in the approach position, an optimum lip contraction ratio appears to exist, with both thinner and thicker lips yielding reduced performance. Author

N78-17999*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

TWO-DIMENSIONAL TRANSONIC TESTING WITH SPLITTER PLATES

Sanford Davis and Bodapati Satyanarayana Feb. 1978 24 p refs

(NASA-TP-1153; A-7221) Avail: NTIS HC A02/MF A01 CSCL 01A

The use of splitter plates for two dimensional transonic testing in wind tunnels was investigated on a 12% biconvex airfoil section over the Mach number range 0.6 to 1.0. Measured pressure distributions were compared to transonic theory and to other experiments, including an investigation in the same facility without splitter plates. The results of the experiment show the best agreement with theory over the entire transonic Mach number range. Author

N78-18000*# Battelle Columbus Labs., Ohio.

ANALYTICAL STUDY OF A FREE-WING/FREE-TRIMMER CONCEPT Final Report

Richard F. Porter, David W. Hall, Joe H. Brown, Jr., and Gerald M. Gregorek Feb. 1978 130 p refs

(Contract NAS4-2378)

(NASA-CR-2946) Avail: NTIS HC A07/MF A01 CSCL 01A

The free-wing/free-trimmer is a NASA-Conceived extension of the free-wing concept intended to permit the use of high-lift flaps. Wing pitching moments are balanced by a smaller, external surface attached by a boom or equivalent structure. The external trimmer is, itself, a miniature free wing, and pitch control of the wing-trimmer assembly is effected through a trailing-edge control tab on the trimmer surface. The longitudinal behavior of representative small free-wing/free-trimmer aircraft was analyzed. Aft-mounted trimmer surfaces are found to be superior to forward trimmers, although the permissible trimmer moment arm is limited, in both cases, by adverse dynamic effects. Aft-trimmer configurations provide excellent gust alleviation and meet fundamental stick-fixed stability criteria while exceeding the lift capabilities of pure free-wing configurations. Author

N78-18001# Naval Ship Research and Development Center, Bethesda, Md.

DRAG, FLOW TRANSITION, AND LAMINAR SEPARATION ON NINE BODIES OF REVOLUTION HAVING DIFFERENT FOREBODY SHAPES

John L. Power Dec. 1977 59 p refs

(AD-A048274; DTNSRDC-77-0065) Avail: NTIS HC A04/MF A01 CSCL 20/4

Resistance has been measured of nine bodies of revolution, having equal volume but varying forebody shapes. Forebody shapes ranged from extremely blunt to extremely fine and included two that were flat faced. The forebodies were altered by changing

their length-to-diameter ratios (L/D's) and prismatic coefficients. Drag results indicate that when the prismatic coefficient is fixed and the L/D is decreased, the residual resistance will increase modestly. Increasing the prismatic coefficient at small L/D's increases residual resistance; however, at moderate L/D's it does not. The results suggest that a flat-faced shape in itself does not increase resistance. In addition to resistance experiments, transition regions on the models were located, using hot film probes. Calculations predicted laminar separation on five of the model forebodies. The hot film measurements confirmed that separation did occur at the locations predicted; downstream of the separation locations, turbulent flow occurred immediately. The remaining four forebodies exhibited well-defined natural transition regions. Flow properties in the transition regions, measured by the hot film gages, have been compared with predicted spatial amplification ratios of disturbances, calculated by linear stability theory. Results have failed to show a single relationship between measured flow properties and computed spatial amplification ratios. Correlation of amplification factors with flow regimes varied, both with forebody shape and Reynolds number. Author (GRA)

N78-18002# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.

PARAMETRIC TRANSONIC EVALUATION OF TYPE A VSTOL NACELLE DRAG Final Report, Jan. - Aug. 1977

Jonah Ottensoser Sep. 1977 47 p refs
(AD-A048110; DTNSRDC/ASED-390) Avail: NTIS
HC A03/MF A01 CSCL 20/4

A parametric evaluation of the zero lift drag characteristics attributable to the large nacelles found on some Type A VSTOL candidate aircraft was conducted in the 7- by 10-foot transonic wind tunnel of the David W. Taylor Naval Ship Research and Development Center. Mounting the nacelles in proximity to the wings and fuselage yields levels of interference drag three to four times the isolated drag which results in the nacelle interference drag producing approximately 50 percent of the total aircraft drag. Movement of the nacelles away from the wings either longitudinally or vertically tends to reduce drag. Except for the nacelles mounted forward of the wing, the nacelles have an adverse effect on lift. The particular wide nose body used proved to be highly unstable longitudinally although adding nacelles above or behind the wings tended to reduce this instability. Five pairs of axisymmetric nacelles, four pairs of pylons, three longitudinal and two vertical positions were investigated on a 10-percent scale, low (supercritical) wing model. Author (GRA)

N78-18003# Air Force Systems Command, Wright-Patterson AFB, Ohio.

INVESTIGATION OF AERODYNAMIC CHARACTERISTICS OF V-WINGS NEAR SOLID SURFACE

N. B. Plisov and F. F. Latypov 13 Jul. 1977 20 p Transl. into ENGLISH from Tr. Leningrad. Korablestroitnogo Instituta (USSR), no. 63, 1968 p 41-49
(AD-A048555; FTD-ID(RS)T-1237-77) Avail: NTIS
HC A02/MF A01 CSCL 20/4

Determined in this study are the position and rotary derivatives of a V-wing moving above a solid screen. This problem is interesting for a number of problems in the dynamics of vehicles which use the screen effect during motion. Studied is a thin V-wing of rectangular plane shape above a solid wall. The induced velocities are considered low, while the vorticity beyond the wing lies in planes corresponding to the planes of the wing. These assumptions are realized at small angles of attack, relatively great distances between the wing and surface, and when the amplitudes of the harmonic oscillations are small. The condition of equality to zero of the normal velocity component of liquid particles should be satisfied on the solid screen. GRA

N78-18004# Air Force Systems Command, Wright-Patterson AFB, Ohio.

THE MOVEMENT OF A WING WITH DEFLECTED AILERONS CLOSE TO A SCREEN

V. G. Belinskiy and Yu. I. Laptev 16 Jul. 1977 17 p Transl. into ENGLISH from Gidrodinamika Bolshikh Skorostey (USSR), no. 4, 1968 p 39-48
(AD-A048651; FTD-ID(RS)T-1238-77) Avail: NTIS
HC A02/MF A01 CSCL 20/4

The effect of a free surface on the characteristics of an underwater wing with deflected ailerons showed that the proximity of a free surface decreases the lift and rolling moment but increases the induced drag and the yawing moment. This work has obtained simple analytical dependences which permit estimating the effect of the proximity of a solid screen on the hydrodynamic characteristics of a wing with deflected ailerons. GRA

N78-18005# Naval Postgraduate School, Monterey, Calif.

CIRCULATION CONTROL AIRFOIL STUDY Progress Report, Jan. - Nov. 1977

Louis V. Schmidt 21 Nov. 1977 32 p refs
(AD-A048677; NPS-67SX77111; PR-4) Avail: NTIS
HC A03/MF A01 CSCL 20/4

The unsteady aerodynamics, and in particular the transfer functions, applicable to the circulation control airfoils were evaluated in an unsteady flow 2 x 2 ft. wind tunnel. Preliminary results were obtained disclosing the nature of unsteady surface pressures over the airfoil, both amplitude and phase, relative to the oscillating cavity pressures for a range of reduced frequencies, k = 0 to 0.46, at a model attitude approximating the zero lift condition (blowing-off) at a moderate value of momentum blowing coefficient. Positive results were obtained towards indentifying the behavior of the Coanda sheet dynamics, airfoils lift transfer function and airfoil damping moment. GRA

N78-18006# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio. Flight Control Div.

CAMBERED JET-FLAPPED AIRFOIL THEORY WITH TABLES AND COMPUTER PROGRAMS FOR APPLICATION Final Report, Jun. 1976 - Apr. 1977

Henry W. Woolard and Bernard F. Niehaus Sep. 1977 161 p refs
(AD-A048528; AFFDL-TR-77-63) Avail: NTIS
HC A08/MF A01 CSCL 20/4

A quadrature method is derived for calculating the incompressible-flow aerodynamics of arbitrarily cambered jet-flapped airfoils. The anticipated application of the methodology is to high-speed subsonic flows (combat maneuvering aircraft) via the use of compressible-flow similarity transformations. The method yields the aerodynamic properties in terms of integrals having integrands which consist of the product of the camber-line ordinate and an influence function which is a parametric function of the jet-momentum coefficient. In general, the integrals involved must be evaluated by numerical methods. Tables of the necessary influence functions are given in the report. GRA

N78-18007# Tennessee Univ. Space Inst., Tullahoma.

FUNDAMENTAL STUDIES OF SUBSONIC AND TRANSONIC FLOW SEPARATION. PART 2: SECOND PHASE SUMMARY REPORT Final Report, Jan. 1974 - Sep. 1975

J. M. Wu, C. H. Chen, T. H. Moulden, K. C. Reddy, and F. G. Collins Dec. 1977 194 p refs
(Contract F40600-74-C-0009)
(AD-A048615; AEDC-TR-77-10321-Pt-2) Avail: NTIS
HC A09/MF A01 CSCL 20/4

The work reported herein represents the second phase of a fundamental study of subsonic and transonic flow separation. The detailed features of the turbulent boundary layer flow separation induced by a foward-facing step in transonic and high subsonic flow were studied. The influences of an upstream disturbance upon the downstream separation were simulated by several shallow-cavity models of different depth to length ratios. The free-stream conditions were varied over the ranges M = 0.6 to approx. 0.9 and Re/ft = 5 x 10 to 6th power to approx. 30 x 10 to the 6th power. It was shown that certain upstream disturbances can produce higher separation pressure and skin friction than related to a single forward-facing step. A separation pressure correlation was established empirically from the cavity flow data. It was observed that a certain Reynolds number and depth-to-length-ratio cavity yielded a maximum separation pressure. At the same time, an increase of free-stream Mach number continuously increased the separation pressure. The flow relaxation along the cavity floor was explored by systematic measurements and analysis of surface pressures and velocity profiles. These studies revealed that the flow relaxation started from the floor and spread outward. Therefore, the lower portion of the outer layer of the shear flow contained a longer memory,

carrying the influence of the upstream disturbance to the downstream separation. The law of the wall and the wake was used for the analysis of the velocity distributions and the estimation of the skin friction. It was found that the slope of the law of the wall is different for velocity profiles of different strengths of wake. GRA

N78-18008# Rockwell International Corp., Thousand Oaks, Calif. Science Center.

A COMPUTATIONAL MODEL FOR THREE-DIMENSIONAL INCOMPRESSIBLE SMALL CROSS FLOW WALL JETS Final Report, 30 Jun. 1976 - 30 Jun. 1977

Norman D. Malmuth and R. K. Szeto 15 Dec. 1977 108 p (Contract N62269-76-C-0382)

(AD-A048450; SC5079.5FR; NADC-76-105-30) Avail: NTIS HC A06/MF A01 CSCL 20/4

A computational model based on H. Keller's box scheme has been used to characterize turbulent incompressible wall jets in the small cross flow approximation prototypic of flows over upper-surface-blown and augmenter wings. Submerged and coflowing cases are considered. An eddy viscosity model was used to simulate the effects of turbulence. Approximate models are identified for flows in which the jet height tends to zero. If the span flow is introduced through a lateral curvature term appearing in the spanwise momentum equation, the effect of the turbulent coupling on the surface pressures, and peak spanwise velocities is weak. Author (GRA)

N78-18009# National Aerospace Lab., Amsterdam (Netherlands). Flight Dynamics Div.

COLLECTION OF SUPERCRITICAL AEROFOILS OBTAINED WITH THE NLR HODOGRAPH METHOD

J. A. VanEgmond and J. W. Boerstoel 7 Sep. 1977 57 p refs

(Contract NIVR-1754)

(NLR-TR-75115-U) Avail: NTIS HC A04/MF A01

Graphical and tabulated data of eighteen airfoils, calculated with the NLR transonic hodograph theory is presented to show the possibilities of the calculation method for application in airfoil design studies. Author (ESA)

N78-18010# Dornier-System G.m.b.H., Friedrichshafen (West Germany).

INFLUENCE OF WING TAPERING ON THE DEVELOPMENT OF A THREE-DIMENSIONAL TURBULENT BOUNDARY LAYER EXEMPLIFIED WITH A TRANSONIC WING [EINFLUSS DER FLUEGELZUSPITZUNG AUF DIE ENTWICKLUNG EINER DREIDIMENSIONALEN, TURBULENTEN GRENZSCHICHT AM BEISPIEL EINES TRANSSONISCHEN TRAGFLUEGELS]

H. W. Stock Bonn DOKZENTBw 1977 32 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung

(BMVg-FBWT-77-7) Avail: NTIS HC A03/MF A01; DOKZENTBw DM 20

The influence of the taper ratio of a wing was studied using a three-dimensional transonic wing. The results obtained for a section in the middle of the tapered wing were calculated using the same boundary layer method as for an infinite swept wing with an identical pressure distribution and a sweep angle, which corresponds to the sweep angle at 50 % chord of the three-dimensional wing. It is shown that the boundary layer integral thicknesses and their gradients in the chordwise direction are larger for the infinite swept wing than for the three-dimensional wing. Marked differences were produced for the wall streamline angle beta. For the three-dimensional wing beta was negative from the leading to the trailing edge, i.e., the boundary layer mass is pushed into a direction towards the fuselage (alpha + beta smaller than 0). For the infinite swept wing beta was positive for x/c greater than .5 and became fairly large in the region of the trailing edge, i.e., the boundary layer mass is pushed in a direction towards the wing tip (alpha + beta greater than 0). Author (ESA)

N78-18011# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Hauptabt. Flugbetrieb.

CALCULATION OF THE HORIZONTAL TAIL LOADS FROM ELEVATOR ACTUATION

Jean Skudridakis 1976 129 p refs In GERMAN; ENGLISH summary

(DLR-IB-536-76/4) Avail: NTIS HC A07/MF A01

An investigation was made of horizontal tail loads in maneuvering flight conditions as a result of different kinds of stabilizer inputs. To achieve a reasonable approach to the problem the complete longitudinal set of equations of motion were simplified concerning the degrees of freedom of the system which were significantly reduced from 6 to 3 or 2 deg. With these simplifications the equations of motions were solved by analog computer, numerical integration, or by Laplace transforms. A detailed set of elevator input time histories and related equations is presented, according to MIL-A-008861 A (USAF). The application of these sets may help to establish conditions which are as close as possible to reality for the calculation of horizontal tail loads with respect to different airworthiness standards and design instructions. The influence of elasticity of the aircraft structure is outlined. Author (ESA)

N78-18012# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Hauptabt. Flugbetrieb.

SUPPORTING INVESTIGATIONS DURING TESTING OF THE WDL-1 AIRSHIP IN GHANA AND UPPER VOLTA

DLR-IB-536-76/3; N78-14002

(DLR-IB-536-77/1;DLR-IB-536-76/3) Avail: NTIS HC A04/MF A01

An evaluation is presented of the hull temperature measurements and flight data recorded during the test flight of an airship (blimp) in July and August, 1976, in Ghana and Upper Volta. The hull temperature data and related environmental parameters allow analyzing the heat transfer characteristics of the hull, the emission behavior of the surface, and the heat transfer coefficients as a function of the flow velocity. The flight data provide insight into the airship's operational performance, especially maximum and minimum cargo and fuel consumption. ESA

N78-18013# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).

A METHOD FOR CALCULATION OF THE PRESSURE DISTRIBUTION OF WING-BODY CONFIGURATIONS FOR LARGE ANGLE OF ATTACK AT SUBSONIC SPEED [EIN VERFAHREN ZUR BERECHNUNG DER DRUCKVERTEILUNG VON FLUEGEL-RUMPFANORDNUNGEN BEI HOHER ANSTELLUNG IM UNTERSCHALLBEREICH]

G. Gregoriou Bonn DOKZENTBw 1977 33 p refs In GERMAN; ENGLISH summary

(Contract T/RF-41/RF-410/51106)

(BMVg-FBWT-77-15) Avail: NTIS HC A03/MF A01; DOKZENTBw DM 20

An iterative singularity method was developed based on the potential theory which yields the pressure distribution of symmetric wing-body configurations in the nonlinear angle of attack range at subsonic speeds. The body is axisymmetric and of finite length and arbitrary thickness. The wing is infinitely thin and located at mid-wing position. The following mathematical model was used: 1) wing: lattice method, free vortices partially inclined to the wing plane; 2) body: ring sources over the body surface. Author (ESA)

N78-18014# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Abt. Elastomechanik und Aeroelastische Stabilitaet.

APPLICATION AND COMPARISON OF MODAL PERTURBATION METHODS AND MODAL CORRECTION PROCEDURES EXEMPLIFIED BY A SWEPT WING WITH TWO EXTERNAL STORES

Raymond Freymann 27 May 1977 44 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-463)

(DLR-FB-77-21) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 22.60

Investigations on a swept wing model structure with two external stores were carried out by applying modal perturbation methods and modal correction methods to inertia modifications on the external stores. Experimental modal data resulting from ground vibration tests on the same model structure in two different

configurations were partially compared with calculated modal data in order to check the accuracy and suitability of the different modification methods. Author (ESA)

N78-18015# Technische Hochschule, Aachen (West Germany). Inst. fuer Luft- und Raumfahrt.

DESIGN AND CALIBRATION OF 5-POINT CONICAL PRESSURE PROBES FOR MEASURING IN SUPERSONIC FLOW

Hans-Gerd Neuhaeuser and Dieter Coors Cologne DFVLR 27 Jun. 1977 46 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-464)
(DLR-FB-77-28) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 21,40

A survey is given on design and calibration of a 5-point conical pressure probe for measuring flow angle, Mach-number, static pressure, and total pressure. The pressures measured at the boreholes of the probe are combined to give nondimensional expressions. The determination of the single flow parameters results from the calculation of polynomials the coefficients of which are determined according to the calibration data by means of least squares criteria. The accuracy of the calibration is demonstrated by comparing the measurement of a flow angle in the flow area of a cone and of a double cone, respectively, with theoretical data. Possibilities of improving the instrument quality by corrections to the evaluations are discussed.
Author (ESA)

N78-18016# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Angewandte Gasdynamik.

THEORETICAL INVESTIGATION OF THE VISCID FLOW AROUND A FLAT PLATE WITH GROUND EFFECT

Wolfgang Geller 19 Aug. 1977 28 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-468)
(DLR-FB-77-35) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 14,10

The incompressible laminar flow field past a flat plate with ground effect was calculated by numerical integration of the vorticity transport equation and the Poisson equation for the stream function. Results show that, for slot heights of 0.9 to 4 % of the plate length and for a Reynolds number, related to the plate length and the velocity far upstream of the plate, of 1000, the flow in the slot between the plate and the moving ground is similar to a Couette flow with a small negative pressure gradient in the flow direction. The viscous effect of the flow produces a high pressure in the slot which generates a lifting force together with the low pressure on the upper surface of the plate. Author (ESA)

N78-18017# European Space Agency, Paris (France).

ANALYTICAL SOLUTION OF THE GENERALIZED HELMHOLTZ WAVE EQUATION FOR COMPRESSIBLE SUBSONIC FLOW AND CALCULATION OF THE UNSTEADY PRESSURE DISTRIBUTIONS ABOUT OSCILLATING SPHEROIDS

Kuang-Lai Chao Jan. 1978 44 p refs Transl. into ENGLISH of 'Anal. Loesung der verallgemeinerten Helmholtz-Wellengleichung fuer kompressible Unterschallstroemung u. Berechnung der instationaeren Druckverteilungen an harmonisch schwingenden rotationselliptischen Koerpern', DFVLR, Goettingen, West Ger. Report DLR-FB-77-11, 28 Mar. 1977 Original report in GERMAN previously announced as N77-30431 Original German report available from DFVLR, Cologne DM 18,90
(ESA-TT-421; DLR-FB-77-11) Avail: NTIS HC A03/MF A01

Analytical solutions for inviscid compressible subsonic flow were derived within the framework of linear unsteady aerodynamics. The method of separation of variables was used to solve the generalized Helmholtz wave equation analytically. The solutions were obtained in a non-orthogonal spheroidal coordinate system. The unsteady pressure distributions on oscillating spheroids were calculated using the spheroidal wave functions. Author (ESA)

N78-18018# European Space Agency, Paris (France).

UNSTEADY PRESSURE MEASUREMENTS ON WING-STORE COMBINATIONS IN INCOMPRESSIBLE FLOW

Hermann Triebstein Jan. 1978 78 p refs Transl. into ENGLISH of 'Instationaere Druckverteilungsmessungen an Fluegel-Aussenlastkombinationen in inkompressibler Stroemung', DFVLR, Goettingen, West Ger. Report DLR-FB-77-12, 28 Mar. 1977 Original report in GERMAN previously announced as N78-11017 Original German report available from DFVLR, Cologne DM 36,20
(ESA-TT-426; DLR-FB-77-12) Avail: NTIS HC A05/MF A01

Measurements of unsteady pressures on harmonically oscillating wingstore combinations in incompressible flow are dealt with. The measurements were made in a subsonic wind tunnel. The pressure was measured for yaw-, pitch-, and heave oscillations of the store at different locations of the store in x-, y-, and z-direction. The pitching and yawing oscillations were made about two different axes. Further unsteady pressure distributions were measured on the wing-store combination at harmonically pitching oscillations of the wing and on the store at pitching and heaving oscillations of the store without the wing. Some results were compared with theoretical results. The flow speed was V = 40 m/s and the oscillation frequencies were f = 6, 12 and 20 Hz. Author (ESA)

N78-18019# National Aerospace Lab., Amsterdam (Netherlands). Flight Dynamics Div.

PHAROS, PROCESSOR FOR HARMONIC ANALYSIS OF THE RESPONSE OF OSCILLATING SURFACES

P. H. Fuijkschot 21 Apr. 1977 10 p Presented at the 7th Intern. Congr. on Instrumentation in Aerospace Simulation Facilities, Wiltshire, Engl., Sep. 1977
(NLR-MP-77012-U) Avail: NTIS HC A02/MF A01

A computer controlled system is described which was primarily developed for investigating the relation between the movement of a harmonically excited windtunnel model and the resulting unsteady pressure distribution. The application and the relevant measurement techniques are outlined, and a functional description of the configuration is given. Some of the more interesting electronic principles are discussed. PHAROS is essentially an accurate multichannel transfer function analyzer (TFA) with a frequency range of 0 to 10 kHz. The TDA operation is performed on all channels simutaneously, giving high speed. In addition to the fundamental components, the amplitude and phase of higher harmonics can be established, allowing a time waveform reconstruction of non-linear phenomena. Author (ESA)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N78-18020 Colorado Univ., Boulder.

A SIMULATION MODEL FOR AN ENPLANING-PASSENGER-VEHICLE CURBSIDE AT HIGH-VOLUME AIRPORTS Ph.D. Thesis

Charles Allen Hall 1977 297 p
Avail: Univ. Microfilms Order No. 77-29923

How simulation of airport activities at the enplaning curbside can be used to accurately determine the efficiency of this important portion of the airport is described. Simulation requires validating the computer model against the airport curbside system it simulates and was done by statistical comparisons between measured and computed quantities that were based on data taken at three airports. A series of simulation models were developed. The variables in the models include: (1) number of lanes; (2) number of spaces per lane; (3) interarrival patterns; (4) vehicle class distribution; (5) service times; (6) exit methods. Dissert. Abstr.

N78-18021# Federal Aviation Administration, Atlantic City, N.J. National Aviation Facilites Experimental Center.

THE ANALYSIS OF NATIONAL TRANSPORTATION SAFETY BOARD LARGE FIXED-WING AIRCRAFT ACCIDENT/INCIDENT REPORTS FOR THE POTENTIAL PRESENCE OF LOW-LEVEL WIND SHEAR Final Report

Jack J. Shrager Dec. 1977 84 p refs

(FAA Proj. 154-451-110)
(AD-A048354; FAA-NA-77-41; FAA-RD-77-169) Avail: NTIS HC A05/MF A01 CSCL 01/2

The National Transportation Safety Board aircraft accident/incident data base covering the years 1964 through 1975 was screened to select those accidents involving aircraft of 12,500 pounds gross weight or greater in which the potential of low level wind shear as a factor could not be discounted. The successive filtering techniques employed eliminated all but 25 of the 59,465 accidents or incidents which comprised the total data base used. The presence of a low level wind shear was a distinct possibility in these 25 takeoff or approach and landing accidents/incidents. Author

N78-18022# Naval Postgraduate School, Monterey, Calif.
A COMPARISON OF INTEGRATED AND CONVENTIONAL COCKPIT WARNING SYSTEMS M.S. Thesis
Joseph Dennis Mazza Sep. 1977 42 p refs
(AD-A048670) Avail: NTIS HC A03/MF A01 CSCL 01/4

An experiment was performed in which seventeen subjects responded to warning signals presented on displays simulating integrated and conventional aircraft cockpit warning systems. Performance using the conventional system was superior in terms of both mean reaction time and number of errors committed. Author (GRA)

N78-18023# Coast Guard, Washington, D.C.
PRELIMINARY TESTS OF INFLATABLE LIFERAFTS FOR STABILITY IN HIGH WINDS Final Report
M. R. Daniels, Jr., R. L. Markle, and S. G. Maness 1 Dec. 1977 39 p
(AD-A048722; USCG-M-1-78) Avail: NTIS HC A03/MF A01 CSCL 06/7

This report presents the results of a preliminary investigation of the stability of various marine-type inflatable liferafts when afloat and exposed to high wind forces. The report describes capsizings resulting from wind forces generated by helicopter downdraft and the slipstream of a fixed-wing aircraft. Author (GRA)

N78-18024*# Chicago Univ., Ill. Dept. of the Geophysical Sciences.
AN ANALYSIS OF THREE WEATHER-RELATED AIRCRAFT ACCIDENTS
T. Theodore Fujita and Fernando Caracena (Environ. Res. Lab., Boulder, Colo.) Apr. 1977 44 p refs Submitted for publication Sponsored in part by NSF
(Grants NGR-14-001-008; NOAA-04-4-158-1)
(NASA-CR-155363; PB-275090/9; SMRP-RP-145; NOAA-77101302) Avail: NTIS HC A03/MF A01 CSCL 01B

Two aircraft accidents in 1975, one at John F. Kennedy International Airport at New York City on June 24 and the other at Stapleton International Airport at Denver on August 7, were examined. The third accident on June 23, 1976 at Philadelphia International Airport is being investigated. All accidents occurred as aircraft, either descending or climbing, lost altitude while experiencing strong wind shear inside downburst cells. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N78-18025*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FLIGHT TEST RESULTS OF THE STRAPDOWN HEXAD INERTIAL REFERENCE UNIT (SIRU). VOLUME 2: TEST REPORT
Ronald J. Hruby and William S. Bjorkman (Analytical Mechanics Associates, Inc., Mountain View, Calif.) Jul. 1977 96 p refs
(NASA-TM-73223; A-6973) Avail: NTIS HC A05/MF A01 CSCL 17G

Results of flight tests of the Strapdown Inertial Reference Unit (SIRU) navigation system are presented. The fault tolerant SIRU navigation system features a redundant inertial sensor unit and dual computers. System software provides for detection and isolation of inertial sensor failures and continued operation in the event of failures. Flight test results include assessments of the system's navigational performance and fault tolerance. Performance shortcomings are analyzed. Author

N78-18026# Transportation Systems Center, Cambridge, Mass.
CHARACTERIZATION OF CURRENT TOWER CAB ENVIRONMENTS Interim Report, Jan. - Mar. 1977
V. J. Hobbs, D. F. Clapp, P. Rempfer, D. Devoe, J. Bellantoni, L. Maddock, J. Raudseps, L. Stevenson, J. R. Coonan, J. Kuhn et al Nov. 1977 207 p refs
(AD-A048306; DOT-TSC-FAA-77-19; FAA-EM-77-10) Avail: NTIS HC A10/MF A01 CSCL 13/3

A description of the general tower cab environment is given in terms of: (a) the evolution of the tower cab, current cab classification and staffing levels, and the basic flow of Air Traffic Control data relevant to cab operations; (b) a breakdown of functions performed by tower cab personnel, the basic equipment used to perform those functions, and allocation of equipment and responsibilities to various controller positions; and (c) current tower related systems and procedures, including airspace surveillance, surface surveillance, flight data handling and the role of the flight progress strip, air/ground communications, the data processing and display systems, weather related systems, and current landing systems. Author

N78-18027# Lincoln Lab., Mass. Inst. of Tech., Lexington.
UPLINK COVERAGE MEASUREMENTS IN THE LOS ANGELES AREA FOR PASSIVE BCAS
F. Nagy, Jr. 7 Nov. 1977 31 p
(Contracts DOT-FA77WAI-727; F19628-78-C-0002; FAA Proj. 052-241-04)
(AD-A048288; ATC-81; FAA-RD-77-134) Avail: NTIS HC A03/MF A01 CSCL 01/4

Uplink (1030 MHz) measurement results are presented, based on data recorded by the Airborne Measurement Facility during normal landings and takeoffs at the LAX, Van Nuys, and San Diego airports. The data presented are relevant to current investigations of passive beacon-based collision avoidance systems and include: (1) the interrogator environment as received; (2) its division between FAA and other interrogators; (3) its dependence on aircraft height during landings and take-offs; and (4) the availability of P2 pulses of sufficient strength for PRF (pulse repetition frequency) tracking. The number of interrogators was found to increase with the aircraft height at the rate of 2.5 to 3 interrogators per 1000 ft. Thus, P2 pulse tracking appears to be feasible down to 2000 ft. at LAX, and lower at San Diego. Author

N78-18028*# Research Triangle Inst., Research Triangle Park, N. C.
CONTINUED INVESTIGATION OF POTENTIAL APPLICATION OF OMEGA NAVIGATION TO CIVIL AVIATION
Ernest G. Baxa, Jr. Mar. 1978 207 p refs
(Contract NAS1-13290)
(NASA-CR-145307; RTI-4378-1009-F) Avail: NTIS HC A10/MF A01 CSCL 17G

Major attention is given to an analysis of receiver repeatability in measuring OMEGA phase data. Repeatability is defined as the ability of two like receivers which are co-located to achieve the same LOP phase readings. Specific data analysis is presented. A propagation model is described which has been used in the analysis of propagation anomalies. Composite OMEGA analysis is presented in terms of carrier phase correlation analysis and the determination of carrier phase weighting coefficients for minimizing composite phase variation. Differential OMEGA error analysis is presented for receiver separations. Three frequency analysis includes LOP error and position error based on three and four OMEGA transmissions. Results of phase amplitude correlation studies are presented. Author

N78-18029# Northrop Corp., Norwood, Mass. Precision Products Div.
PERFORMANCE CHARACTERISTICS OF AN ATTITUDE VELOCITY ACCELERATION AND RATE UNIT (NIS-210-24) Final Report, Jun. 1975 - Jul. 1976
L. Elvey and G. Kern Wright-Patterson AFB, Ohio AFAL Aug. 1977 94 p
(Contract F33615-75-C-1239)
(AD-A048204; AFAL-TR-76-221) Avail: NTIS HC A05/MF A01 CSCL 17/7

This report summarizes the test results obtained in the laboratory on the Northrop NIS-210-24 Attitude, Velocity, Acceleration and Rate Sensing Unit (AVAR). The AVAR is a three gyro, three accelerometer strapdown unit mounted on a single gimbal, organized to sense the body rates of the vehicle in which it is mounted. Included in the AVAR unit is a processor which accepts the sensor digital information and transforms the body reference information into a stable inertial frame. For the purpose of these tests, the AVAR provided the inertial information to a commercial HP computer which solved the navigation equations. The testing performed on the unit utilizing the gimbal to provide azimuth rotation indicated 3-5 naut. miles per hour performance capability. Author (GRA)

N78-18030# Rockwell International Corp., Anaheim, Calif. Autonetics Group.
MICRO NAVIGATOR (MICRON) PHASE 2B. VOLUME 1: TECHNICAL REPORT Final Technical Report, 5 Aug. 1975 - 25 Feb. 1977
Joseph M. Miller, A. P. Andrews, T. F. Brasher, H. L. Bump, J. D. Courtier, K. J. Gibson, F. J. Gulde, F. R. Hall, D. W. Holmes, K. K. Jin et al Wright-Patterson AFB, Ohio AFAL Aug. 1977 354 p refs
(Contract F33615-75-C-1301)
(AD-A048000; C75-787/201-Vol-1; AFAL-TR-77-138-Vol-1) Avail: NTIS HC A16/MF A01 CSCL 17/7

The Micro Navigator (MICRON) is a low-cost, highly reliable, and moderately accurate strapdown inertial navigator. The heart of the MICRON system is the micro-electrostatic gyro (MESG), an instrument which incorporates an all-attitude, whole-angle readout from an electrostatically suspended rotor. Under previous Air Force contracts two developmental navigation systems (N57A-1 and N57A-2) were designed, fabricated, and flight tested. Two gyro subassemblies for developmental testing were designed, fabricated, and integrated. The overall objective of the MICRON Phase 2B contract was to design, develop, fabricate, and integrate the Engineering Prototype MICRON (EPM) and its associated software and test equipment. The specific objectives were to develop a MICRON system resulting in high reliability, ease of maintenance, low acquisition cost, and moderate performance, and be a potential candidate as the inertial navigation unit (INU) for the F-16. One EPM was designed, fabricated, assembled, and integrated. The EPM meets the performance requirements of the Phase 2B contract and the F-16 packaging envelope requirements. Spares were fabricated and tested to support maintenance of the EPM. Test Equipment, system software, and test station software were developed and verified. System analyses, studies, and tradeoffs were made which resulted in improved accuracy, reliability, producibility, and life cycle costs. Design specifications were prepared and maintained. GRA

N78-18031# Ministry of Defence, Haifa (Israel). Armament Development Authority.
THE CLOSED FORM SOLUTION OF TRUE PROPORTIONAL NAVIGATION Final Report, 1 Apr. - 30 Sep. 1974
Mauricio Guelman Sep. 1974 53 p refs
(Grant AF-AFOSR-2679-74)
(AD-A048008; AFAL-TR-74-351) Avail: NTIS HC A04/MF A01 CSCL 16/2

The closed form solution of the equations of motion of an ideal missile pursuing a non-maneuvering target according to the true proportional navigation (TPN) law is obtained. In this case, commanded accelerations are applied in a direction normal to the interceptor-target line of sight. A linearized analysis is applied to study the TPN and a circle is found where capture can be demonstrated. A major point of this study is that the analysis of the closed form solution of TPN enables one to demonstrate the basic differences existing between the two most utilized forms of proportioned navigation, namely that pure proportional navigation has a much different capture envelope than the circle described for TPN. Author (GRA)

N78-18032# IIT Research Inst., Annapolis, Md.
THE IMPACT OF A PROPOSED ACTIVE BCAS ON ATCRBS PERFORMANCE IN THE WASHINGTON, D. C., 1981 ENVIRONMENT Final Report
Norman Theberge Sep. 1977 48 p refs
(Contracts F19628-76-C-0017; DOT-FA70WAI-175)
(AD-A048589; ECAC-PR-77-037; FAA-RD-77-140) Avail: NTIS HC A03/MF A01 CSCL 17/7

A computer model of the proposed active Beacon Collision Avoidance System (BCAS) was developed to investigate the impact of BCAS on the Air Traffic Control Radar Beacon System (ATCRBS) ground system. Predictions were made for the early 1981 Washington, D.C., environment. Two ground environments were simulated, an all-ATCRBS environment and a 25%/75% Discrete Address Beacon System (DABS)/ATCRBS mix. Airborne fruit rates and the effect of BCAS/DABS mode power programming on interference were also predicted. Author (GRA)

N78-18033# Federal Electric Corp., Vandenberg AFB, Calif.
AMBIGUOUS RANGE STUDY REPORT Final Report, 11 Feb. - 30 Jun. 1977
R. B. Pickett 30 Jun. 1977 46 p refs
(Contract F04701-72-C-0203)
(AD-A048612; PA100-77-31; SAMTEC-TR-77-222) Avail: NTIS HC A03/MF A01 CSCL 17/7

A continuing objective at the SAMTEC West is to provide data which will permit evaluation of inertial guidance (IG) system performance. Recent computer simulations indicate that better results could be obtained if low noise range data were used instead of range and range data obtained from current instrumentation. Several techniques are presented for obtaining low noise range data. It is shown that comparatively simple modifications to existing instrumentation systems may prove to be satisfactory. Tests are recommended to determine if these modifications are actually feasible. Author (GRA)

N78-18034# Teledyne Systems Co., Northridge, Calif.
LORAN AUTOMATIC VEHICLE MONITORING SYSTEM, PHASE 1. VOLUME 1: TEST RESULTS Final Report
R. Stapleton and F. Chambers Aug. 1977 286 p
(Contract DOT-TSC-1238-1)
(PB-274955/4; TSC-50463-1-Vol-1; DOT-TSC-UMTA-77-30-1-Vol-1; UMTA-MA-06-0041-77-10-Vol-1) Avail: NTIS HC A13/MF A01 CSCL 13F

The system was based on operator need and thus will be available to all potential AVM (Automatic Vehicle Monitoring) users in the transit industry as well as law enforcement or any other candidate industry. Performance characteristics measured were location accuracy, time of passage accuracy, and coverage. Currently the coverage area is more than 16 million square miles. GRA

N78-18035# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Flugfunk und Mikrowellen.
A LOCATION AND NAVIGATION METHOD WITH TRAVELING ISOPHASES [EIN ORTUNGS- UND NAVIGATIONSVERFAHREN MIT WANDERNDEN ISOPHASEN]
F. Stelzel 1 Jul. 1977 30 p refs In GERMAN
(DLR-IB-551-77/4) Avail: NTIS HC A03/MF A01

The traveling isophase system proposed by Gaudillere for radio navigation was investigated from the accuracy point of view. The operation of this radio-mesh system is independent of the carrier frequency used. The frequency may be optimally selected in agreement with the topology and the application. Simple and conjugated isophases are considered, and a proposal is made for realization of a system consisting of four transmitters. ESA

N78-18036# Mitre Corp., McLean, Va. METREK
CONCEPTS FOR ESTIMATING CAPACITY OF BASIC RUNWAY CONFIGURATIONS
F. A. Amodeo, A. L. Haines, and A. N. Sinha M.[illegible]. 1977 50 p

refs
(Contract DOT-FA70WA-2448)
(PB-274578/4; MTR-7115-Rev-1) Avail: NTIS
HC A03/MF A01 CSCL 01B

One method of evaluating the impact of changes in the governing longitudinal separation standards on final approach is through the estimation of runway capacity. The arrival stream is analyzed with respect to the applicable longitudinal separation standards, ATC system performance and the interactions with departures, if any, as governed by the appropriate ATC rules and procedures. Concepts are developed for arrival only, departure only, arrival/departure, dual-lane, and intersecting runway configurations. GRA

N78-18037# Mitre Corp., McLean, Va. METREK Div.
BENEFITS OF MLS GUIDANCE FOR CURVED APPROACHES. VOLUME 2: OPERATIONAL BENEFITS FOR NEW YORK AIRPORTS
R. R. Iyer Jul. 1975 52 p refs
(Contract DOT-FA70WA-2448)
(PB-274585/9; MTR-6951-Vol-2) Avail: NTIS
HC A04/MF A01 CSCL 01C

Projected benefits of curved approaches during marginal VFR and IFR weather conditions provided by implementing MLS at LaGuardia and Kennedy are investigated. It is shown that the operational flexibility due to MLS contributes the following benefits: increases in capacity at LGS during IFR and marginal VFR conditions, reductions in airport noise exposure over populated areas around JKF and LGA, reductions in NASCOM delays at LGA and savings in operating costs for airlines by terminal route reductions. GRA

N78-18038# Mitre Corp., McLean, Va. METREK Div.
CONCEPTS FOR DETERMINATION OF LONGITUDINAL SEPARATION STANDARDS ON FINAL APPROACH
A. L. Haines Oct. 1975 44 p refs
(Contract DOT-FA70WA-2448)
(PB-274590/9; MTR-7047) Avail: NTIS HC A03/MF A01
CSCL 01C

Definitions are developed with a view toward identifying the relationships between separation standards and the variables describing the final approach environment. This provides a basis for systematic evaluation of changes in separation standards due to changes in the environment, particularly through Engineering and Development products. Analytical relationships are developed primarily for IFR conditions, represented by strict adherence to all applicable ATC rules and procedures. For modeling purposes, relationships are also developed for 'standards' for VFR conditions, represented by visual approaches from an IFR flight plan. GRA

N78-18039# Teledyne Systems Co., Northridge, Calif.
LORAN AUTOMATIC VEHICLE MONITORING SYSTEM, PHASE 1. VOLUME 2: APPENDICES Final Report, Oct. 1976 - Feb. 1977
R. Stapleton and F. Chambers Aug. 1977 160 p
(Contract DOT-TSC-1238-2)
(PB-274956/2; TSC-50463-1-Vol-2-App;
DOT-TSC-UMTA-77-30-2-App;
UMTA-MA-06-0041-77-11-Vol-2) Avail: NTIS
HC A08/MF A01 CSCL 13F

Contents included Loran calibration data; special case test data sheets; augmentor location summary; typical monitor station strip chart recording; and a report of inventions. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N78-18040 Washington Univ., Seattle.
APPLICATION OF SYSTEM IDENTIFICATION TO ANALYTIC ROTOR MODELING FROM SIMULATED AND WIND TUNNEL DYNAMIC TEST DATA Ph.D. Thesis
Debashis Banerjee 1977 202 p
Avail: Univ. Microfilms Order No. 77-28337

Aircraft state and parameter identification methods are introduced. A simplified form of the Maximum Likelihood method is selected to extract analytical aeroelastic rotor models from simulated and dynamic wind tunnel tests results for accelerated cyclic pitch stirring excitation. The goal is to determine the dynamic inflow characteristics for forward flight conditions from the blade flapping responses without direct inflow measurements. Reverse flow effects are considered for high rotor advance ratios. Two inflow models are studied; the first is based on an equivalent blade Lock number, the second is based on a time delayed momentum inflow. Basic rotor parameters are identified together with measurement bias values. The effect of the theoretical dynamic inflow on the rotor eigenvalues is studied. A relation between the accuracy of the identified parameters and the length of input data is established in simulation studies. Dissert. Abstr.

N78-18041*# National Aeronautics and Space Administration, Washington, D. C.
A NEW HELICOSTAT FROM SNIAS HELICOPTER DIVISION
J. Morisset Dec. 1977 15 p refs Transl. into ENGLISH from Air Cosmos (France), no. 653, 8 Jan. 1977 p 19-22 and 40 Trans. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-2791)
(NASA-TM-75063) Avail: NTIS HC A02/MF A01 CSCL 01C

The Helicostat was described as a helicopter in which the vehicle weight is nullified by two balloons arranged in a catamaran fashion. Development of such a vehicle is discussed, and various uses for these helicopters are summarized. Author

N78-18042*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
FLIGHT TESTS OF A RADIO-CONTROLLED AIRPLANE MODE WITH A FREE-WING, FREE-CANARD CONFIGURATION
Shu W. Gee 1978 13 p refs
(NASA-TM-72853; H-1008) Avail: NTIS HC A02/MF A01
CSCL 01C

Flight characteristics, controllability, and potential operating problems were investigated in a radio-controlled airplane model in which the wing is so attached to the fuselage that it is free to pivot about a spanwise axis forward of its aerodynamic center and is subject only to aerodynamic pitching moments imposed by lift and drag forces and a control surface. A simple technique of flying the test vehicle in formation with a pickup truck was used to obtain trim data. The test vehicle was flown through a series of maneuvers designed to permit evaluation of certain characteristics by observation. The free-wing free-canard concept was determined to be workable. Stall/spin characteristics were considered to be excellent, and no effect on longitudinal stability was observed when center of gravity changes were made. Several problems were encountered during the early stages of flight testing, such as aerodynamic lockup of the free canard and excessive control sensitivity. Lack of onboard instrumentation precluded any conclusions about gust alleviation or ride qualities. Author

N78-18043*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AEROMECHANICAL STABILITY OF HELICOPTERS WITH A BEARINGLESS MAIN ROTOR. PART 1: EQUATIONS OF MOTION
Dewey H. Hodges Feb. 1978 102 p refs Prepared in cooperation with Army Aviation Res. and Develop. Command, Moffett Field, Calif.
(NASA-TM-78459; A-7301-Pt-1) Avail: NTIS
HC A06/MF A01 CSCL 01C

Equations of motion for a coupled rotor-body system were derived for the purpose of studying air and ground resonance characteristics of helicopters that have bearingless main rotors. For the fuselage, only four rigid body degrees of freedom are considered; longitudinal and lateral translations, pitch, and roll. The rotor is assumed to consist of three or more rigid blades. Each blade is joined to the hub by means of a flexible beam segment (flexbeam or strap). Pitch change is accomplished by

twisting the flexbeam with the pitch-control system, the characteristics of which are variable. Thus, the analysis is capable of implicitly treating aeroelastic couplings generated by the flexbeam elastic deflections, the pitch-control system, and the angular offsets of the blade and flexbeam. The linearized equations are written in the nonrotating system retaining only the cyclic rotor modes; thus, they comprise a system of homogeneous ordinary differential equations with constant coefficients. All contributions to the linearized perturbation equations from inertia, gravity, quasi-steady aerodynamics, and the flexbeam equilibrium deflections are retained exactly. Author

N78-18044*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A FLIGHT EVALUATION OF A TRAILING ANEMOMETER FOR LOW-SPEED CALIBRATIONS OF AIRSPEED SYSTEMS ON RESEARCH AIRCRAFT

Bruce D. Fisher, Bruce J. Holmes, and H. Paul Stough, III Feb. 1978 62 p refs

(NASA-TP-1135; L-11960) Avail: NTIS HC A04/MF A01 CSCL 01C

Research airspeed systems on three low-speed general aviation airplanes were calibrated by the trailing anemometer method. Each airplane was fitted with an NASA pitot-static pressure tube mounted on either a nose or wing boom. The uncalibrated airspeed systems contained residual static-pressure position errors which were too large for high-accuracy flight research applications. The trailing anemometer calibration was in agreement with the tower flyby calibration for the one aircraft for which the comparison was made. The continuous deceleration technique for the trailing anemometer method offers reduced test time with no appreciable loss of accuracy for airspeed systems with pitot-static system lag characteristics similar to those described. Author

N78-18045*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

FUSELAGE STRUCTURE USING ADVANCED TECHNOLOGY METAL MATRIX FIBER REINFORCED COMPOSITES Patent Application

Robert K. Robinson (Boeing Commercial Airplane Co., Seattle) and Harry M. Tomlinson, inventors (to NASA) (Boeing Commercial Airplane Co., Seattle) Filed 16 Feb. 1978 15 p Sponsored by NASA

(NASA-Case-LAR-11688-1; US-Patent-Appl-SN-878540) Avail: NTIS HC A02/MF A01 CSCL 01C

A fuselage structure in which the skin is comprised of layers of a metal matrix fiber reinforced composite is described. The plies of the composite material are built up so as to take advantage of the unidirectional properties of strength and stiffness of the composite material with alternate plies of material oriented at approximately 45 deg and approximately 315 deg to the fuselage longitudinal axis. The stringers, which run longitudinally and support the skin are also reinforced with layers of metal matrix fiber reinforced material oriented at approximately 0 deg relative to the fuselage longitudinal axis. The metal matrix fiber reinforced composite used in the preferred embodiment is borsic aluminum. Borsic aluminum is comprised of silicone coated boron fibers embedded in an aluminum matrix which results in a fuselage structure that is significantly lighter than a similar fuselage of titanium. NASA

N78-18046# Advisory Group for Aerospace Research and Development, Paris (France).

FATIGUE DESIGN OF FIGHTERS: GUIDELINES FOR OBTAINING AND MAINTAINING ADEQUATE FATIGUE PERFORMANCE OF TACTICAL AIRCRAFT

Jan. 1978 138 p refs

(AGARD-AG-231; ISBN-92-835-1271-5) Avail: NTIS HC A07/MF A01

Guidelines are presented to establish recommended procedures for fatigue conscious design of aircraft, with special reference to tactical aircraft. Steps of the design process are outlined and for each step, based on current knowledge, those procedures most likely to provide adequate fatigue performance are given. For individual titles, see N78-18047 through N78-18052.

N78-18047# National Aerospace Lab., Amsterdam (Netherlands).

FATIGUE DESIGN OF FIGHTERS; GUIDELINES FOR OBTAINING AND MAINTAINING ADEQUATE FATIGUE PERFORMANCE OF TACTICAL AIRCRAFT: GENERAL SURVEY

J. B. deJonge *In* AGARD. Fatigue Design of Fighters: Guidelines for Obtaining and Maintaining Adequate Fatigue Performance of Tactical Aircraft Jan. 1978 p 6-11 refs (For availability see N78-18046 09-05)

Avail: NTIS HC A07/MF A01

In the structural design process of a new aircraft, a number of successive stages can be defined. Four successive phases are distinguished here; (a) The definition phase: In this phase, the basic structural lay-out, including the type of structure and materials to be used is determined. (b) The development phase: In this phase the detail design of the structure takes place. (c) The prototype and production phase: This phase is characterised by the assessment of the performance of the new aircraft and its certification. (d) The service phase: The aircraft has entered service and is being subjected to its actual operational environment. The impact of fatigue on the structural design and the considerations with regard to the fatigue phenomenon in each of these successive phases are discussed. Author

N78-18048# Air Force Systems Command, Wright-Patterson AFB, Ohio. Structures Div.

THE DEVELOPMENT OF FATIGUE/CRACK GROWTH ANALYSIS LOADING SPECTRA

J. E. Holpp and M. A. Landy *In* AGARD. Fatigue Design of Fighters: Guidelines for Obtaining and Maintaining Adequate Fatigue Performance of Tactical Aircraft Jan. 1978 p 13-41 refs (For availability see N78-18046 09-05)

Avail: NTIS HC A07/MF A01

The processes involved in developing a realistic loading spectrum are described. The purpose of developing a realistic loading spectrum is to define a stress-time history that is representative of those stresses encountered by a component during actual usage. The discussion centers around developing load and stress spectrum for aircraft structural (airframe) components, particularly fighter or strike aircraft. The realism of the spectrum is determined by the accuracy of the input from the different disciplines and the degree of complexity that the analyst is willing, or able, to go to. There are many external factors to be considered in the spectrum development process. Among these are time and money considerations, available data, degree of accuracy required, etc. These factors may require the use of simpler, less time consuming techniques than one would prefer to use for real.sm's sake. The steps involved in the processes include: (1) Mission profile definition, (2) Loading environment, (3) Loading conditions, (4) Structural loads analysis, (5) Stress analysis, and (6) Stress sequencing. Author

N78-18049# Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany).

CALCULATION METHODS FOR FATIGUE LIFE AND CRACK PROPAGATION

Walter Schutz *In* AGARD. Fatigue Design of Fighters: Guidelines for Obtaining and Maintaining Adequate Fatigue Performance of Tactical Aircraft Jan. 1978 p 45-76 refs (For availability see N78-18046 09-05)

Avail: NTIS HC A07/MF A01

A number of more or less well known methods to calculate fatigue life in the crack initiation and crack propagation phases are discussed. Each section is divided into two sub-sections: present status and potential improvements. Methods are classified as present status when they are used widely in industry, examined by systematical test programs or are simply outgrowths of older methods and no improvement can be expected for fundamental reasons. They are classified as potential improvements when they offer some hope for improvement compared to the present status but this has not been conclusively proved. Thus a method will be in the potential improvements section when it has not been thouroughly examined experimentally, although it may have been around for many years. Author

N78-18050# Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany).

TESTS ON DETAILS AND COMPONENTS

K. Ahrensdorf *In* AGARD. Fatigue Design of Fighters: Guidelines for Obtaining and Maintaining Adequate Fatigue Performance of Tactical Aircraft, Jan. 1978 p 77-106 refs (For availability see N78-18046 09-05)
Avail: NTIS HC A07/MF A01

The fatigue life of critical components and/or the reaction of their structures to cracks must be determined to serve as a basis for fatigue life calculation and the final layout of fatigue-critical components. Such fatigue tests are often combined with detailed stress analyses. Also carried out are specimen tests to determine the crack propagation rates for the materials used and the crack growth in critical areas. Specimen tests are employed to complement the component tests because even in this early phase, it is not only interesting to find out how the structure will react to a mission mix used for fatigue verification, but it is also necessary to investigate the influence of variations of mission mix. These trade-off studies give information about the limitations in life associated with different usage. A seemingly more severe load spectrum may yield a longer life. Author

N78-18051# Royal Aircraft Establishment, Farnborough (England).
CURRENT STANDARDS OF FATIGUE TEST ON STRIKE AIRCRAFT
R. D. J. Maxwell *In* AGARD. Fatigue Design of Fighters: Guidelines for Obtaining and Maintaining Adequate Fatigue Performance of Tactical Aircraft Jan. 1978 p 107-116 refs (For availability see N78-18046 09-05)
(AGARD-AR-92) Avail: NTIS HC A07/MF A01

Many types of aircraft are operated by countries other than those in which the aircraft were designed and tested. It is important, therefore, that sufficient information on major tests is made available to enable the airworthiness authorities of all user countries to interpret the tests in terms of their own requirements and monitoring systems. The discussion outlines in an advisory manner a list of the steps necessary to achieve the above objectives and to recommend those procedures, based on current knowledge, most likely to produce acceptable outputs at each step. The presentation is divided into three sections: (1) a brief statement of the objectives of a fatigue test and a list of the essential steps needed to achieve those objectives, (2) a summary of the recommendations of the way in which each of the steps should be carried out, and (3) a review of the background philosophy associated with the recommendations. Author

N78-18052# National Aerospace Lab., Amsterdam (Netherlands).
FATIGUE LOAD MONITORING
J. B. DeJonge *In* AGARD. Fatigue Design of Fighters: Guidelines for Obtaining and Maintaining Adequate Fatigue Performance of Tactical Aircraft Jan. 1978 p 117-134 refs (For availability see N78-18046 09-05)
Avail: NTIS HC A07/MF A01

For modern fighter aircraft with their usage versatility and desired long operational lives on the one hand and their finite fatigue endurance on the other, monitoring of operational load experience has become indispensable. Monitored loads are used for re-assessing the service life under operational conditions and the inspection intervals for fail-safe structures which are based on crack growth rates in conjunction with loading severity. Methods available for such re-assessment are discussed. Various load monitoring techniques are described and general aspects of fatigue load monitoring are discussed. Author

N78-18053# Army Aviation Engineering Flight Activity, Edwards AFB, Calif.
AIRWORTHINESS EVALUATION NUH-1H HELICOPTER WITH GLOBAL POSITIONING SYSTEM Final Report
Charles L. Thomas and Tom P. Benson May 1977 189 p refs
(AD-A047971; USAAEFA-76-13) Avail: NTIS MF A01 CSCL 01/3

The United States Army Aviation Engineering Flight Activity conducted a limited airworthiness flight evaluation of an NUH-1H helicopter in which a prototype global positioning system (GPS) was installed. Flight tests were conducted at Edwards Air Force Base, California, between 18 and 27 January 1977. Nine test flights were conducted for a total of 11 productive flight hours. Testing was performed to determine the effect of GPS installation on vibration and pilot-induced oscillation (PIO) characteristics of the NUH-1H helicopter. During this test, one deficiency and one shortcoming were noted. The deficiency was insufficient aft longitudinal control margin in rearward flight. The shortcoming was insufficient directional control margin in hover and low-speed flight. The deficiency and the shortcoming were a result of the gross weight and center of gravity of the helicopter after installation of the GPS, although both were within normal UH-1H operating limits. There was no significant effect on vibration characteristics or increase in PIO tendencies of the NUH-1H as a result of the GPS installation. Author (GRA)

N78-18054# Boeing Vertol Co., Philadelphia, Pa.
LIMITATIONS OF THE CH-47 HELICOPTER IN PERFORMING TERRAIN FLYING WITH EXTERNAL LOADS Final Report, Jul. 1976 - Apr. 1977
Irvin B. Alansky, James M. Davis, and Theodore S. Garnett, Jr. Aug. 1977 161 p refs
(Contract DAAJ02-76-C-0028)
(AD-A048580; D210-11225-1; USAAMRDL-TR-77-21) Avail: NTIS HC A08/MF A01 CSCL 01/2

Quantitative limitations of the CH-47 helicopter performing terrain flying with external loads have been developed using a fully coupled total force and moment simulation math model of the helicopter and external load. Load sway motion and susceptibility to pilot induced oscillations in night/instrument meteorological conditions were identified as the prime source of these limitations. Masking considerations were determined for various external load configurations, including an 8x8x20-foot MILVAN and a 155mm howitzer. Incorporation of load stabilization (AAELSS), coupled with a shortened sling suspension or a Self-Hoisting Cargo Interface Device, offers the best potential for alleviating the limits identified, while providing improved masking requirements and reductions in pilot workload. In addition, the levels of maneuverability possible with the present state-of-the-art visionic systems (including FLIR and NVG) were defined for terrain flying during night operations. Author (GRA)

N78-18055# Grumman Aerospace Corp., Bethpage, N.Y.
FLIGHT QUALIFICATION OF TITANIUM F-14A AIRFRAME COMPONENTS MANUFACTURED BY HOT ISOSTATIC PRESSING (HIP) Final Report, 1 Nov. 1975 - 31 Mar. 1977
R. Witt Jun. 1977 116 p refs
(Contract N00019-76-C-0143)
(AD-A048485) Avail: NTIS HC A06/MF A01 CSCL 01/3

This program established that fuselage braces (Part No. A51B21683) manufactured by the hot isostatic pressing (HIP) process can satisfy flight requirements for forged parts. The HIP braces withstood 24,000 equivalent flight hours (four design lives) without failure. The projected cost saving related to the utilization of the HIP process in manufacturing of these parts is in the range of 30 to 40%. Ti-6Al-6V-2Sn titanium alloys consolidated by HIP exhibited excellent fracture toughness and elongation characteristics, and obtained K sub ic and percent elongation values in the range of 69-74 ksi sq root of in and 15-16%, respectively. Representative F sub tu and F sub ty values were approximately 3% below the current design specifications for forgings. However, these values can be increased by minor modifications in the oxygen content within allowable limits. Mechanical properties exhibited isotropic characteristics. Reproducibility studies indicated that current tight tolerances for machined components may have to be relaxed to assure that all dimensions of hot isostatically pressed (HIP'd) parts meet design specifications. Experimental welds on HIP and vacuum annealed materials met radiographic and ultrasonic acceptance criteria. Utilization of the HIP process in manufacturing fatigue-critical airframe components will depend on availability of high-quality powders with certified purity standards to insure freedom from inclusions. GRA

N78-18056# National Aerospace Lab., Amsterdam (Netherlands). Scientific Services.
FLIGHT-PATH RECONSTRUCTION OF SYMMETRIC NONSTEADY FLIGHTS
M. VanDerWilt 17 May 1977 35 p refs
(NLR-TR-76133-U) Avail: NTIS HC A03/MF A01

An essential part of the process of determining the aircraft

performance from data of nonsteady flight tests is the so-called flight path reconstruction. A flight path reconstruction with the square-root information formulation of the Kalman filter and smoother is described. This estimation method is applied to a symmetric nonsteady flight. Results of flight path reconstruction are obtained by processing simulated flight test measurements. Author (ESA)

N78-18057# Dornier-System G.m.b.H., Friedrichshafen (West Germany).
IMPROVEMENT OF FLIGHT MEASURING DATA WITH A KALMAN FILTER [VERBESSERUNG DER FLUGMESSDATEN DURCH EIN KALMAN-FILTER]
L. Platzoeder Bonn DOKZENTBw 1977 104 p refs In GERMAN; ENGLISH summary
(Contract T/RF-41/RF-410/51082)
(BMVg-FBWT-77-6) Avail: NTIS HC A06/MF A01; DOKZENTBw DM 30

Improvement of Fiat G91-T3 flight test measuring data using a Kalman filter algorithm was studied. The system equations and the Kalman filter equations are given and the regression analysis is presented. Tests with the Kalman filter FORTRAN computer program, listed in the appendix, are reported and results are discussed. Both the filtering and the one channel smoothing of the measuring data produce an improvement in the regression analysis, but not nearly to the expected extent. Indeed the filtering produces a distinct reduction of the measuring data noise. But it is shown that the regression analysis is insensible to noise, as expected, so that the improvement in the measuring data could not improve the results. Tests with simulated data also show that the filter is very well qualified to filter out systematic errors. In the flight test results this is also seen in the improvements of the multiple correlation coefficient. To summarize, studies with a Kalman-filter-algorithm show the technique to be a valuable tool in dynamic systems parameter identification. Author (ESA)

N78-18058# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Aerodynamik.
MODERN CONCEPTS FOR AERODYNAMIC ROTOR DESIGN
H. Koerner Sep. 1977 87 p refs In GERMAN; ENGLISH summary Presented at the Course of Hubschraubertech. 1, Bundeswehrakad. fuer Wehrverwaltung. u. Wehrtech., Mannheim, West Ger., 29 Sep. 1977
(DLR-IB-151-77/11) Avail: NTIS HC A05/MF A01

As survey of new concepts for the improvement of the aerodynamic performance of rotors is given. Improvements of the conventional hinged rotor are discussed, especially new airfoil sections and modified blade planforms. The new rotor concepts are considered together with aerodynamic problems in connection with new flight vehicles such as compound airplanes. A short survey of the aerodynamic methods available for rotor design is presented. Author (ESA)

N78-18059# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
OPTIMAL LEVEL CONTROLS OF HIGH PERFORMANCE AIRCRAFT [OPTIMALE EBENE STEUERUNGEN VON HOCHLEISTUNGSFLUGZEUGEN]
D. Kraft, G. C. Shau, K. H. Well, and E. Berger 12 Jul. 1977 53 p refs In GERMAN
(DLR-IB-552-77/20) Avail: NTIS HC A04/MF A01

The application of computer programs for the analysis and synthesis of optimal aircraft designs to the problem of optimal controls design is dealt with. The mathematical model of aircraft motion is described. An equations system related to the linearized equations of motion was set up and the necessary optimality conditions formulated. The approximation of aerodynamic and propulsion characteristics is discussed, and an approximation by rational functions is proposed. Two highly developed, fast optimization algorithms are presented, a multitarget and a collocation method. Methods for determining estimated values are outlined. Results of numerical calculations for time and fuel optimized trajectories of two high performance aircraft are presented. ESA

N78-18060# Marconi Space and Defence Systems Ltd., Camberley (England).
THE PHILOSOPHY ADOPTED FOR THE FLIGHT TESTING OF THE PANAVIA TORNADO AVIONICS SYSTEM IN HACK AIRCRAFT
P. H. Morgan 1977 17 p Presented at the Symp. on Data and Inform. Process. in Marine Navigation Systems, Brunel Univ., Uxbridge, Engl., 6 Sep. 1977
Avail: NTIS HC A02/MF A01

The philosophy and techniques adopted for the flight testing of the swing-wing Tornado aircraft digitally based self-contained all-weather NAV/ATTACK avionics system are presented. The subsystems for navigation, displays, flight control, weapon aiming, computing, and data transmission are described. The development organization and development program system are described briefly. The stage 3 flight trials program is detailed. ESA

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N78-18061# Westinghouse Defense and Electronic Systems Center, Baltimore, Md.
F-4E AVIONICS UPDATE Final Report, 15 Jun. - 30 Sep. 1976
A. F. Wenk Aug. 1977 48 p refs
(Contract F33615-76-C-1340)
(AD-A047949; AFAL-TR-77-91) Avail: NTIS HC A03/MF A01 CSCL 19/5

This report covers the final phase of the previous F-4E Austere HUD Program AFAL-TR-76-190, dated December 1976. This report covers live aerial gun firing performance support that Westinghouse provided for the gunsight mechanization previously incorporated in test aircraft No. 304 at AFFTC. The report also covers SEAFAC support work and transformers delivered to SEAFAC. Author (GRA)

N78-18062# Hughes Helicopters, Culver City, Calif. Display Systems Lab.
LIQUID CRYSTAL AIRBORNE DISPLAY Final Technical Report, Mar. 1973 - Dec. 1976
Richard N. Winner, Michael N. Ernstoff, and William R. Byles Aug. 1977 261 p refs
(Contract F33615-73-C-1221)
(AD-A048198; HAC-P76-527R; HAC-Ref-C9383; AFAL-TR-77-18) Avail: NTIS HC A12/MF A01 CSCL 14/2

A solid-state liquid crystal television display panel is described. This display has been developed as a replacement for the cathode-ray tube in direct-view and head-up display applications for tactical aircraft. Its key advantages are: (1) high contrast in small and large areas, (2) gray shade capability under all levels of illumination including direct-sunlight, (3) uniform high resolution over the entire display area, (4) interface similar to CRT TV display and (5) low power, weight, volume. Cockpit installations have been designed for the display which permit viewing under day and night conditions. Measurements have confirmed that the display brightness and contrast remain superior to the CRT for all single-place cockpit viewing positions under anticipated in-flight illumination conditions. The presentation of gray scale television images under direct sunlight illumination has been demonstrated. The display is built using silicon LSI circuit technology to form the metal-oxide semiconductor addressing circuits which define a matrix of electrodes used to directly activate a liquid crystal film. The present display is 2 in. square and consists of 40,000 elements arranged in a 200 x 200 array. Techniques have been successfully illustrated for increasing the size of the display by assembling a mosaic array of modules that are electrically interconnected. GRA

N78-18063# Dynamics Research Corp., Wilmington, Mass.
DIGITAL AVIONICS INFORMATION SYSTEM (DAIS): MID-1980'S MAINTENANCE ANALYSIS Final Report, May 1975 - Oct. 1976

Andrew J. Czuchry, John M. Glasier, Herbert E. Engel, H. Anthony Baran (AFHRL, Wright-Patterson AFB, Ohio), Marjorie A. Bristol, and Duncan L. Dieterly (AFHRL, Wright-Patterson AFB, Ohio) Brooks AFB, Tex. AFHRL Jul. 1977 79 p refs
(Contract F33615-75-C-5218; AF Proj. 2051)
(AD-A047886; AFHRL-TR-77-45) Avail: NTIS HC A05/MF A01 CSCL 09/3

The fundamental objective of the Digital Avionics Information System (DAIS) Life Cycle Cost (LCC) Study is to provide the Air Force with an enhanced in-house capability to incorporate LCC considerations during all stages of the system acquisition process. The purpose of this report is to describe the technical approach, results and conclusions obtained from a Maintenance Task Analysis (MTA) conducted on a mid-1980s DAIS conceptual design configuration to identify and quantify support maintenance task requirements. This conceptual design configuration is one of two developed as bases for determining the maintenance support requirements of DAIS systems. They are described in AFHRL-TR-76-59, Mid-1980s Digital Avionics Information System Conceptual Design Configuration. The first is representative of an application of the DAIS principles of avionics integration to current avionics equipment. The second represents an application of DAIS principles to equipment expected to be operational in the mid-1980s. An MTA was conducted on the current DAIS conceptual design configuration, AFHRL-TR-76-71, Digital Avionics Information System (DAIS): Current Maintenance Task Analysis. Its results provided a baseline for conducting the MTA reported here. The approach taken was to identify major system design changes and innovative support system capabilities projected to be available in the mid-1980s timeframe, along with major mechanization differences between the two conceptual designs. GRA

N78-18064# Environmental Research Inst. of Michigan, Ann Arbor. Radar and Optics Div.
HOLOGRAPHIC COMBINERS FOR HEAD-UP DISPLAYS Final Report, 1 May 1976 - 31 Jan. 1977
W. S. Colburn and B. J. Chang Wright-Patterson AFB, Ohio AFAL Oct. 1977 108 p refs
(Contract F33615-76-C-1182)
(AD-A047998; ERIM-122400-9-F; AFAL-TR-77-110) Avail: NTIS HC A06/MF A01 CSCL 20/6

The use of holographic optical elements as combiners in Head-Up Displays (HUD) offers performance improvements in two respects; because the holographic combiner has a high reflectivity over a narrow spectral region, it can make more efficient use of the light, and by forming the final element of the collimating lens, it can increase the field-of-view. Both improvements were examined separately in an analytical and experimental investigation directed at evaluating holographic combiners in existing HUD systems. Flat holographic combiners that can be substituted on a one-for-one replacement basis for the conventional combiner in an existing HUD were designed and fabricated. The combiners were fabricated in dichromated gelatin, and were characterized by diffraction efficiencies in excess of 90% and angular bandwidths of 10 to 12 deg. A computer analysis of curved holographic combiners in the A-10 HUD generated a design that shows promise for increasing the instantaneous field-of-view to 15 deg and the total field-of-view to 20 deg. GRA

N78-18065# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
PALEFAC Final Report, 1 Mar. 1975 - 31 May 1977
H. B. Chalstrom, Jr. Wright-Patterson AFB, Ohio AFAL Sep. 1977 24 p refs
(Contract F33615-75-C-1206; AF Proj. 2052)
(AD-A048331; R-1087; AFAL-TR-77-167) Avail: NTIS HC A02/MF A01 CSCL 09/2

This report describes the Palefac system which is part of the non-real-time support software of the Digital Avionics Information System (DAIS) of the Air Force Avionics Laboratory (AFAL). Palefac is a tool which aids in the development of real-time flight software for avionics embedded digital computers. This report deals with three aspects of the relationship of Palefac to the DAIS program. Author (GRA)

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N78-18066* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INTEGRATED GAS TURBINE ENGINE-NACELLE Patent
Arthur P. Adamson, Donald F. Sargisson, and Charles L. Stotler, Jr., inventors (to NASA) Issued 25 Oct. 1977 9 p Filed 3 Nov. 1975 Division of US Patent Appl. SN-522108, filed 8 Nov. 1974
(NASA-Case-LEW-12389-2; US-Patent-4,055,041; US-Patent-Appl-SN-628221; US-Patent-Class-60-226R; US-Patent-Class-60-39.31; US-Patent-Class-244-53A; US-Patent-Class-244-54) Avail: US Patent Office CSCL 21E

A nacelle for use with a gas turbine engine is presented. An integral webbed structure resembling a spoked wheel for rigidly interconnecting the nacelle and engine, provides lightweight support. The inner surface of the nacelle defines the outer limits of the engine motive fluid flow annulus while the outer surface of the nacelle defines a streamlined envelope for the engine. Official Gazette of the U.S. Patent Office

N78-18067* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
VARIABLE MIXER PROPULSION CYCLE Patent
Dan Joseph Rundell (GE, Cleveland), Donald Patrick McHugh (GE, Cleveland), Tom Foster (GE, Cleveland), and Ralph Harold Brown, inventors (to NASA) (GE, Cleveland) Issued 24 Jan. 1978 10 p Filed 2 Jun. 1975 Sponsored by NASA
(NASA-Case-LEW-12917-1; US-Patent-4,069,661; US-Patent-Appl-SN-583055; US-Patent-Class-60-204; US-Patent-Class-60-262) Avail: US Patent Office CSCL 21E

A design technique, method and apparatus are delineated for controlling the bypass gas stream pressure and varying the bypass ratio of a mixed flow gas turbine engine in order to achieve improved performance. The disclosed embodiments each include a mixing device for combining the core and bypass gas streams. The variable area mixing device permits the static pressures of the core and bypass streams to be balanced prior to mixing at widely varying bypass stream pressure levels. The mixed flow gas turbine engine therefore operates efficiently over a wide range of bypass ratios and the dynamic pressure of the bypass stream is maintained at a level which will keep the engine inlet airflow matched to an optimum design level throughout a wide range of engine thrust settings. Official Gazette of the U.S. Patent Office

N78-18068*# Pennsylvania State Univ., University Park. Dept. of Mechanical Engineering.
INVESTIGATION OF THE UNSTEADY PRESSURE DISTRIBUTION ON THE BLADES OF AN AXIAL FLOW FAN Final Report, Sep. 1973 - Sep. 1977
Robert E. Henderson and Gary F. Franke Mar. 1978 138 p refs
(Grant NGR-39-009-275)
(NASA-CR-15571) Avail: NTIS HC A07/MF A01 CSCL 21E

The unsteady response of a stator blade caused by the interaction of the stator with the wakes of an upstream rotor was investigated. Unsteady pressure distributions were measured using a blade instrumented with a series miniature pressure transducers. The influence of several geometrical and flow parameters - rotor/stator spacing, stator solidity and stator incidence angle - were studied to determine the unsteady response of the stator to these parameters. A major influence on the stator unsteady response is due to the stator solidity. At high solidities the blade-to-blade interference has a larger contribution. While the range of rotor/stator spacings investigated had a minor influence, the effect of stator incidence angle is significant. The data indicate the existence of an optimum positive incidence which minimizes the unsteady response. Author

N78-18069# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.

GE CORE ENGINE NOISE INVESTIGATION, LOW EMISSION ENGINES Final Report, Jun. 1975 - Dec. 1976

R. K. Matta, G. T. Sandusky, and V. L. Doyle Feb. 1977 286 p refs

(Contract DOT-FA75WA-3688)

(AD-A048590; FAA-RD-77-4) Avail: NTIS HC A13/MF A01 CSCL 20/1

Investigations were conducted to determine the variables affecting source strength, spectrum shape, and farfield directivity. This investigation included scale model tests to evaluate the effects of exhaust nozzle geometry on radiation patterns of low frequency noise. A full-scale combustor rig test was used to identify the controlling variables of combustor noise at the source. Two engines tests were run to validate the findings from the scale model tests and add to the overall data base of core noise measurements. The relationship between combustor source noise and emissions was studied and qualitative trends identified for advanced low emissions combustors. Studies were made of the attenuation of high frequency turbine noise by downstream blade rows, the broadband noise generation by turbines, and the controlling parameters for turbine tone/jet stream interaction. This included a turbine rig test in single and multistage configurations, along with a unique data acquisition system. Scale model tests were used to define the effect of the pertinent aero-acoustic parameters on turbine tone scattering by jet stream turbulence. The results of these investigations were used to improve the component prediction techniques derived under the Core Engine Noise Control Program. Author

N78-18070*# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.

F-15/NONAXISYMMETRIC NOZZLE SYSTEM INTEGRATION STUDY SUPPORT PROGRAM Contractor Report, 24 Feb. 1977 - 30 Sep. 1977

H. L. Stevens Feb. 1978 171 p refs

(Contract NAS3-20608)

(NASA-CR-135252; FR-9232) Avail: NTIS HC A08/MF A01 CSCL 21E

Nozzle and cooling methods were defined and analyzed to provide a viable system for demonstration 2-D nozzle technology on the F-15 aircraft. Two candidate cooling systems applied to each nozzle were evaluated. The F-100 engine mount and case modifications requirements were analyzed and the actuation and control system requirements for two dimensional nozzles were defined. Nozzle performance changes relative to the axisymmetric baseline nozzle were evaluated and performance and weight characteristics for axisymmetric reference configurations were estimated. The infrared radiation characteristics of these nozzles installed on the F-100 engine were predicted. A full scale development plan with associated costs to carry the F100 engine/two-dimensional (2-D) nozzle through flight tests was defined. Author

N78-18071# Calspan Corp., Buffalo, N. Y.

STUDIES OF HEAT TRANSFER TO GAS TURBINE COMPONENTS Final Report, Jun. 1976 - Oct. 1977

Michael G. Dunn and Frank J. Stoddard Wright-Patterson AFB, Ohio AFAPL Oct. 1977 54 p refs

(Contract F33615-76-C-2092)

(AD-A048551; CALSPAN-XE-5933-A-102; AFAPL-TR-77-66) Avail: NTIS HC A04/MF A01 CSCL 21/5

A 180 sector of the first stage stationary inlet nozzle of the AiResearch TFE-731-2 engine was instrumented with thin-film heat-transfer gages and experiments were performed to obtain detailed heat-transfer rate distributions. It is shown that the experimental apparatus can potentially be used to study total-pressure losses in cascades. The experimental apparatus consists of a helium-driven shock tube as a short-duration source of high-temperature high-pressure gas, driving a nozzle test-section device mounted near the exit of a primary shock-tunnel receiver tank. The nozzle test-section device consists of a forward transition section with a circular opening facing the supersonic primary nozzle flow and with the external shape of a frustum of a cone. Internal contouring is provided to transform the circular-section subsonic intake flow into one filling approximately a 180 annular segment having a geometry approximating that of the entrance to the turbine stator stage in a turbojet. Detailed measurements of static pressure in the test section and heat-transfer rate on the stator sector have been obtained and are reported herein. Author (GRA)

N78-18072# Sportavia-Puetzer G.mbH. and Co., K.G. (West Germany).

EXPERIMENTAL DETERMINATION AND COMPARISON WITH THEORY OF THRUST, NOISE AND DRIVING WEIGHT OF PROPELLER DRIVES [EXPERIMENTELLE BESTIMMUNG UND VERGLEICH MIT DER THEORIE VON SCHUB, LAERM UND ANTRIEBSGEWICHT VON PROPELLERANTRIEBEN]

H. Oberdoerster, M. Schliewa, H. Schrecker, and M. Weck Bonn DOKZENTBw 1977 78 p refs In GERMAN; ENGLISH summary

(Contract T/RF-41/RF-410/41110)

(BMVg-FBWT-77-16) Avail: NTIS HC A05/MF A01; DOKZENTBw DM 30

Noise, static thrust, and thrust in flight were experimentally determined for the quiet aircraft, Sportavia S5. Results were compared with those from the calculation method of Hamilton Standard for propeller thrust and Pilatus for propeller noise. Prior conditions for the comparisons were established from comparison test flights for the gliding flight polar error, from measurement of the characteristics of the engine, and from calibrations of the indicating instruments. Weights of propeller and engine for predefined performance and engine speeds were recorded. ESA

N78-18073# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Luftstrahlantriebe.

INVESTIGATION OF THE JET WAKE DISCHARGE FLOW OF A HEAVILY LOADED CENTRIFUGAL COMPRESSOR IMPELLER M.S. Thesis - Tech. Hochschule Aachen

Dietrich Eckardt 18 Jul. 1977 227 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-466)

(DLR-FB-77-32) Avail: NTIS HC A11/MF A01; DFVLR, Cologne DM 91,20

The complex flow field in high performance centrifugal compressors was studied. Newly developed measuring techniques for unsteady static and total pressures (based on semiconductor transducers) as well as flow directions (special hot-wire probe), and a digital data analysis system for fluctuating signals (sampling technique) were tested thoroughly. The loss-affected mixing process of the distorted impeller discharge flow was investigated in detail, in the absolute and relative system, at impeller tip speeds up to 380 m/s. A theoretical analysis proved good coincidence of the test results with the Dean-Senoo theory, which was extended to compressible flows. Author (ESA)

N78-18074# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Antriebstechnik.

FUNDAMENTAL INVESTIGATIONS ON EFFUSION COOLING OF TURBINE BLADES Ph.D. Thesis - Tech. Hochschule Aachen

Heinz Kruse 2 Sep. 1977 110 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-469

(DLR-FB-77-39) Avail: NTIS HC A06/MF A01; DFVLR, Cologne DM 45,80

The realization of effusion cooled turbine blades with porous materials will be difficult. A more promising technique is that of blowing through discrete holes distributed all over the blade surface. The influence of blowing on boundary layer development with special regard to the arrangement of the holes was investigated experimentally at a flat plate model, as was the attainable cooling effectiveness by measurements in hot gas experiments. The boundary layer phenomena at perforated walls with blowing are described by means of an empirical model for the turbulent shear stresses using a two-dimensional calculation method. The results are compared with boundary layer measurements. Author (ESA)

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N78-18075*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
FLIGHT-DETERMINED STABILITY AND CONTROL COEFFICIENTS OF THE F-111A AIRPLANE
Kenneth W. Iliff, Richard E. Maine, and Sandra Thornberry Steers Mar. 1978 91 p refs
(NASA-TM-72851) Avail: NTIS HC A05/MF A01 CSCL 01C

A complete set of linear stability and control derivatives of the F-111A airplane was determined with a modified maximum likelihood estimator. The derivatives were determined at wing sweep angles of 26 deg, 35 deg, and 58 deg. The flight conditions included a Mach number range of 0.63 to 1.43 and an angle of attack range of 2 deg to 15 deg. Maneuvers were performed at normal accelerations from 0.9g to 3.8g during steady turns to assess the aeroelastic effects on the stability and control characteristics. The derivatives generally showed consistent trends and reasonable agreement with the wind tunnel estimates. Significant Mach effects were observed for Mach numbers as low as 0.82. No large effects attributable to aeroelasticity were noted. Author

N78-18076*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
ANALYTICAL STUDY OF RIDE SMOOTHING BENEFITS OF CONTROL SYSTEM CONFIGURATIONS OPTIMIZED FOR PILOT HANDLING QUALITIES
Bruce G. Powers Feb. 1978 60 p refs
(NASA-TP-1148; H-922) Avail: NTIS HC A04/MF A01 CSCL 01C

An analytical study was conducted to evaluate the relative improvements in aircraft ride qualities that resulted from utilizing several control law configurations that were optimized for pilot handling qualities only. The airplane configuration used was an executive jet transport in the approach configuration. The control law configurations included the basic system, a rate feedback system, three command augmentation systems (rate command, attitude command, and rate command/attitude hold), and a control wheel steering system. Both the longitudinal and lateral directional axes were evaluated. A representative example of each control law configuration was optimized for pilot handling qualities on a fixed base simulator. The root mean square airplane responses to turbulence were calculated, and predictions of ride quality ratings were computed by using three models available in the literature. Author

N78-18077# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
THE APPLICATION OF TECHNIQUES FOR PREDICTING STOL AIRCRAFT RESPONSE TO WIND SHEAR AND TURBULENCE DURING THE LANDING APPROACH
L. D. Reid, A. B. Markov, and W. O. Graf Jun. 1977 172 p refs
(UTIAS-215; CN-ISSN-0082-5255) Avail: NTIS HC A08/MF A01

Techniques examined include an experimental approach which collects flow statistics at fixed points along the nominal flight path. The correlations are then employed with a linear aircraft model to predict RMS response. In the second technique studied, turbulence velocities are measured from which aerodynamic forces can be calculated using linear aerodynamics. These measurements can be made by a moving probe in a boundary layer wind tunnel or by a properly instrumented aircraft in the field. B.L.P.

N78-18078# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THE EFFECTS OF EXTERNAL STORES ON THE FLUTTER OF A NON-UNIFORM CANTILEVER M.S. Thesis
Van C. Sherrer Dec. 1977 105 p refs
(AD-A048360; AFIT-GAE/AA/77D-13) Avail: NTIS HC A06/MF A01 CSCL 20/4

A computer study of the effects of external stores simulated by lumped masses was conducted with a finite element, cantilever, nonuniform wing model. The NASTRAN (Level 16.0) computer program flutter format was used to obtain flutter speeds and frequencies. Mass balancing with a single concentrated mass caused a reduction in flutter speed as the mass was moved chordwise toward the trailing edge and spanwise toward the wing tip. Flutter speeds and frequencies of a 100 lb and a 200 lb store, simulated by two equal masses, were compared to an equivalent concentrated mass at the store center of gravity. The stores consistently raised the flutter frequency over that of the single mass, but flutter speed results were not conclusive. Author (GRA)

N78-18079# Sandia Labs., Albuquerque, N. Mex. Combustion Applications Div.
SPLIT-OPERATOR, FINITE DIFFERENCE SOLUTION FOR AXISYMMETRIC LAMINAR JET DIFFUSION FLAMES
R. J. Kee and J. A. Miller Apr. 1977 22 p refs Presented at AIAA Computational Fluid Dyn. Conf., Albuquerque, N. Mex., 3 Jun. 1977 Submitted for publication
(Contract EY-76-C-04-0789)
(SAND-77-8502; Conf-770620-1) Avail: NTIS HC A02/MF A01

A split-operator numerical method is developed to solve the steady, laminar diffusion flame problem. Splitting the chemical kinetic terms from the fluid mechanical terms ameliorates some of the difficulties associated with the disparate time scales and stiffness in the set of equations which describe highly exothermic diffusion flames. Implicit differencing methods enhance the numerical stability of both operators. Special care is taken to maintain the accuracy of the solution, and the coordinate system is continuously varied to follow the flame shape so that the complex interaction between the fluid mechanics and the finite-rate chemical kinetics in a flame can be studied. ERA

N78-18080# National Aerospace Lab., Amsterdam (Netherlands). Space Flight Div.
FLIGHT TEST OF STICK FORCE STABILITY IN ATTITUDE-STABILIZED AIRCRAFT
H. A. Mooij and M. F. C. VanGool 18 May 1977 7 p refs Presented at the AIAA 4th Atmospheric Flight Conf., Hollywood, Fla., 8-10 Aug. 1977
(NLR-MP-77015-U) Avail: NTIS HC A02/MF A01

The need of artificially generated positive stick force stability for longitudinal flight control systems based on pitch-rate-command/attitude-hold (PRC/AH) has been investigated in two flight test programs using a Beechcraft Queen Air-80 and a Fokker F-28/Mk6000. The main conclusion, based on statistical analysis of performance measures and 'effort ratings' of 120 approaches, is that positive stick force stability reduces airspeed deviations from the reference speed at the cost of increased glide path deviations and increased pilot effort. Only for relatively small levels of positive stick force stability was a modest reduction of airspeed deviation obtained, while glide path tracking and pilot effort were not significantly degraded as compared to the case of neutral stick force stability. Author (ESA)

N78-18081# European Space Agency, Paris (France).
DETERMINATION OF DYNAMIC CHARACTERISTICS FROM FLIGHT TEST DATA
Martin Marchand Dec. 1977 29 p refs Transl. into ENGLISH of 'Ein Verfahren fuer die Bestimmung von dynamischen Flugeigenschaftskenngroessen aus Flugversuchsdaten', DFVLR, Brunswick Report DLR-FB-77-26, 20 Jun. 1977 Original report in GERMAN previously announced as N78-14044 Original German report available from DFVLR, Cologne DM 13.20
(ESA-TT-434; DLR-FB-77-26) Avail: NTIS HC A03/MF A01

An evaluation procedure for the determination of dynamic characteristics from flight test data was developed. The procedure uses a gradient method for the evaluation of eigenvalues and a regression method for the calculation of eigenvectors. The procedure was programmed in FORTRAN and successfully applied during a handling qualities assessment of a fighter aircraft. The procedure is described and some results from both simulation and flight testing are presented. Author (ESA)

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N78-18082 Virginia Univ., Charlottesville.
OPTIMAL AIRCRAFT SIMULATOR DEVELOPMENT BY ADAPTIVE RANDOM SEARCH OPTIMIZATION Ph.D. Thesis
Guy Otis Beale, Jr. 1977 180 p
Avail: Univ. Microfilms Order No. 77-28601

An Adaptive Random Search technique was developed for parameter optimization. The result of the optimization process is a discrete time transfer function to be used as an integration operator in the simulation of closed loop, nonlinear, dynamic systems. The transfer function is optimized for the particular system being simulated. The search for the optimum parameter set is guided by past successful parameter values. A vector valued performance criterion is used with the optimization procedure. This allows the consideration of several cost functions simultaneously. For a particular simulation trial to be considered successful, no element of the performance vector may increase in value, and at least one element must decrease. The optimization technique was applied to the simulation of aircraft motion in a vertical plane, as well as to a more general twelfth order aircraft model. Dissert. Abstr.

N78-18083* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FULL COLOR HYBRID DISPLAY FOR AIRCRAFT SIMULATORS Patent
Wendell D. Chase, inventor (to NASA) Issued 25 Oct. 1977 11 p Filed 17 Oct. 1975 Supersedes N76-10148 (14 - 01, p 0021)
(NASA-Case-ARC-10903-1; US-Patent-4,055,004; US-Patent-Appl-SN-623536; US-Patent-Class-35-12N; US-Patent-Class-358-104) Avail: US Patent Office CSCL 14B

A full spectrum color monitor, connected to the camera and lens system of a television camera supported by a gantry frame over a terrain model simulating an aircraft landing zone, projects the monitor image onto a lens or screen visually accessible to a trainee in the simulator. A digital computer produces a pattern corresponding to the lights associated with the landing strip onto a monochromatic display, and an optical system projects the calligraphic image onto the same lens so that it is superposed on the video representation of the landing field. The optical system includes a four-color wheel which is rotated between the calligraphic display and the lens, and an apparatus for synchronizing the generation of a calligraphic pattern with the color segments on the color wheel. A servo feedback system responsive to the servo motors on the gantry frame produces an input to the computer so that the calligraphically generated signal corresponds in shape, size and location to the video signal. Official Gazette of the U.S. Patent Office

N78-18084*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LASER VELOCIMETER SURVEY ABOUT A NACA 0012 WING AT LOW ANGLES OF ATTACK
Danny R. Hoad (Army Aviation Research and Development Command), James F. Meyers, Warren H. Young, Jr. (Army Aviation Research and Development Command), and Timothy E. Hepner (Army Aviation Research and Development Command) Jan. 1978 155 p refs
(NASA-TM-74040) Avail: NTIS HC A08/MF A01 CSCL 14B

An investigation was conducted in the Langley V/STOL tunnel with a laser velocimeter to obtain measurements of airflow velocities about a wing at low angles of attack. The applicability of the laser velocimeter technique for this purpose in the V/STOL tunnel was demonstrated in this investigation with measurement precision bias calculated at -1.33 percent to 0.91 percent and a random uncertainty calculated at + or - 0.47 percent. Free stream measurements were obtained with this device and compared with velocity calculations from pitot static probe data taken near the laser velocimeter measurement location. The two measurements were in agreement to within 1 percent. Velocity measurement results about the centerline at 0.6 degrees angle of attack were typically those expected. At 4.75 degrees, the velocity measurements indicated that a short laminar separation bubble existed near the leading edge with an oscillating shear layer. Author

N78-18085*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DESIGN AND PERFORMANCE EVALUATION OF SLOTTED WALLS FOR TWO-DIMENSIONAL WIND TUNNELS
Richard W. Barnwell Feb. 1978 33 p refs
(NASA-TM-78648) Avail: NTIS HC A03/MF A01 CSCL 14B

A procedure for designing slotted walls for two dimensional wind tunnels is is presented. The design objective is the minimization of blockage of streamline curvature or the reduction of both. The slotted wall boundary condition is derived both for flow from the tunnel into the plenum and vice versa, and the procedure for evaluating wall interference is described. A correlation of experimental data for the slotted wall boundary condition is given. Results are given for several designs and evaluations of slotted wind tunnel walls. Author

N78-18086*# Southampton Univ. (England).
THE 0.1m SUBSONIC CRYOGENIC TUNNEL AT THE UNIVERSITY OF SOUTHAMPTON
M. J. Goodyer Jan. 1978 43 p refs
(Grant NsG-7172)
(NASA-CR-145305) Avail: NTIS HC A03/MF A01 CSCL 14B

The design and performance of a low speed one atmosphere cryogenic wind tunnel is described. The tunnel is fan driven and operates over the temperature range 305K to 77K at Mach numbers up to 0.28. It is cooled by the injection and evaporation of liquid nitrogen in the circuit, and the usual test gas is nitrogen. The tunnel has a square test section 0.1m across and was built to allow, at low costs, the development of testing techniques and the development of instrumentation for use in cryogenic tunnels, and to exploit in general instrumentation work the unusuallly wide range of unit Reynolds number available in such tunnels. The tunnel was first used in the development of surface flow visualization techniques for use at cryogenic temperatures. Author

N78-18087# Appli-Mation, Inc., San Diego, Calif.
AUTOMATED WEAPON SYSTEM TRAINER: EXPANDED ADAPTIVE MODULE FOR BASIC INSTRUMENT FLIGHT MANEUVERS Final Report, Jun. 1974 - Jul. 1976
John P. Charles and Robert M. Johnson Orlando, Fla. Naval Training Equipment Center Aug. 1977 204 p refs
(Contract N61339-74-C-0141)
(AD-A048498; AISR/376; NAVTRAEQUIPC-74-C-0141-1) Avail: NTIS HC A10/MF A01 CSCL 05/9

Previous studies have demonstrated the conceptual and technical feasibility of automated and adaptive aviation simulator training. This study was concerned with exploring the impact of operational syllabi and training requirements on these advanced techniques. The Advanced Jet Instrument Training syllabus was selected and analyzed. A demonstration of the application of automated and adaptive techniques to the syllabus was conducted utilizing the R and D simulator at the Naval Training Equipment Center. Several new approaches to performance measurement, syllabus structuring and training control were developed to meet the syllabus requirement and training objectives. The techniques and applications were successfully demonstrated. Author (GRA)

N78-19042*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TWO-DIMENSIONAL OSCILLATING AIRFOIL TEST APPARATUS
Frank L. Gibson, Andrew J. Hocker, Jr., and Dennis S. Matsuhiro *In* NASA. Goddard Res. Center The 11th Aerospace Mech. Symp. Apr. 1977 p 171-178 (For availability see N78-19026 09-99)
Avail: NTIS HC A11/MF A01 CSCL 14B

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N78-18088*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AIAA/MSFC SYMPOSIUM ON SPACE INDUSTRIALIZATION: PROCEEDINGS
1976 627 p refs Proc. held at Huntsville, Ala., 26-27 May 1976
(NASA-CP-2026) Avail: NTIS HC A99/MF A01 CSCL 22A

Current and projected technologies required for utilizing extraterrestrial environments to produce energy, information, or materials and provide services of value on Earth or to Earth are discussed. Topics include: space habitats, space transportation, materials processing, solar space power, and exoindustrial management concepts. A.R.H.

N78-18089*# National Aeronautics and Space Administration, Washington, D. C.
A SPACE NECKLACE ABOUT THE EARTH
G. Polyakov Dec. 1977 10 p Transl. into ENGLISH from Tekhn. Molodezhi (USSR), no. 4, 1977 p 41-43 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Astrakhan Teaching Inst. (USSR)
(NASA-TM-75174) Avail: NTIS HC A02/MF A01 CSCL 22A

A space elevator is forecasted for the first quarter of the 21st century, that will consist of a cable attached at the earth's equator, suspended in space by an artificial satellite in geosynchronous orbit. It is stated that such a transport system will supplement rockets as the railway supplements aircraft. Specific aspects of the system are examined, including provisions for artificial gravity, the development of special composite construction materials exhibiting high strength and low mass, and spacecraft launching from the elevator. B.L.P.

N78-18090*# Alabama Univ., University. College of Engineering.
PLANNING FOR MATERIALS PROCESSING IN SPACE Final Report
Sep. 1977 348 p refs Presented at Eng. Systems Design Summer Faculty Fellowship Program, Huntsville, Ala., summer 1977; sponsored in part by Am. Soc. for Eng. Educ.
(Grant NGT-01-002-095)
(NASA-CR-155786) Avail: NTIS HC A15/MF A01 CSCL 22A

A systems design study to describe the conceptual evolution, the institutional interrelationships, and the basic physical requirements to implement materials processing in space was conducted. Planning for a processing era, rather than hardware design, was emphasized. Product development in space was examined in terms of fluid phenomena, phase separation, and heat and mass transfer. The effect of materials processing on the environment was studied. A concept for modular, unmanned orbiting facilities using the modified external tank of the space shuttle is presented. Organizational and finding structures which would provide for the efficient movement of materials from user to space are discussed. Author

N78-18091*# National Aeronautics and Space Administration, Washington, D. C.
THE NEXT 25 YEARS: INDUSTRIALIZATION OF SPACE: RATIONALE FOR PLANNING
Jesco VonPuttkamer 1976 29 p refs Presented at Southeast 2001: The Next 25 Years. World Future Soc. Conf., Atlanta, 12-13 Nov. 1976
(NASA-TM-79360) Avail: NTIS HC A03/MF A01 CSCL 22A

The goals of NASA's space industralization program include contributing to increased productivity on earth without taxing the environment, generating new values through extraterrestrial productivity, and providing new growth options for the future which include the permanent settlement of space and long-range colonization and exploration projects. In planning the long-range space program based on essentially utilitarian aspects, without losing sight of the more humanistically significant long term, and to forecast associated technology requirements, a realistic approach is obtained by combining extrapolative and normative planning modes so that common stepping stones can be identified. In the extrapolative view, alternative futures are projected on the basis of past and current trends and tendencies. In the normative view, some ideal state in the far future is envisioned or postulated, and policies and decisions are directed toward its attainment. A.R.H.

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N78-18092*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EQUAL PERIOD ORBIT DETERMINATION FOR THE SOLAR SYSTEM PLANETS
Wilbur H. Funston 10 Jan. 1978 37 p
(NASA-TM-78156) Avail: NTIS HC A03/MF A01 CSCL 22A

The determination of a set of equations is presented for equi-period orbits work. A set of figures for quick reference are provided as well. Author

N78-18093# Computer Code Consultants, Solana Beach, Calif.
HYDRO CODE STUDY Final Report, May - Nov. 1977
Wallace E. Johnson 30 Dec. 1977 40 p refs
(Contract DASG60-77-C-0095)
(AD-A048553; CCC-BMD-F77) Avail: NTIS HC A03/MF A01 CSCL 20/13

A study was performed to determine if a 3D hydrodynamic code coupled with strength of materials formulation exists which is capable of predicting failure or break-up due to the interaction of a projectile (or multiple interactions) with a reentry vehicle system. This study investigated ten potential 3D modeling techniques, to determine if an existing three-dimensional hydrodynamic code exists which has the capability of analyzing the BMD hypervelocity impact problem. Results of this study and future recommendations are included. Author (GRA)

N78-18094# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
ORBIT DETERMINATION AND ORBIT PREDICTION FROM MEASURED DATA USING THE ELKORR PROGRAM [BAHNBESTIMMUNG UND -VORHERSAGE AUS MESSDATEN MIT DEM PROGRAMM ELKORR. VERFAHRENS- UND ERFAHRUNGSBERICHT]
K. Zimmermann 12 Aug. 1977 87 p refs In GERMAN Report will also be announced as translation (ESA-TT-447)
(DLR-IB-552-76/10) Avail: NTIS HC A06/MF A01

Satellite orbit determination based on the Differential Orbit Improvement (DOI) procedure is discussed. The DOI technique is reduced to minimization of the quadratic loss function. The relation between the quadratic loss function and the required expectation value and the observational covariance matrix is derived. Thus a comparison between the DOI and the extended Kalman filter theory can be made. The relation between the information matrix and the covariance matrix is dealt with. The procedure used in ELKORR to change and update measured data sets is derived. The procedure for solving the system and measured data equations as well as the required variance calculation are presented schematically. Application results to near earth and geostationary satellites are given and data processing and program organization aspects are treated. ESA

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air).*

N78-18095# Air Force Avionics Lab., Wright-Patterson AFB, Ohio. Reconnaissance and Weapon Delivery Div.
A STAR SCENE SIMULATOR FOR TEST AND EVALUATION OF IMAGING SYSTEMS USED IN POINT-SOURCE DETECTION Interim Application Report, Jan. 1973 - Apr. 1975
Peter L. Manly and Ronald E. Wiensch Aug. 1977 39 p refs
(AD-A048201; AFAL-TR-77-151) Avail: NTIS HC A03/MF A01 CSCL 20/6

In order to expedite test and evaluation of television and other photoelectronic sensors for space surveillance applications in the detection of faint spacecraft or distant missiles, a star scene simulator was developed which allows the convenient simulation of point sources over a brightness range of 17 stellar magnitudes (Factor of 6,000,000). This report discusses the basis for the simulator, its performance, and provides illustrations of its use. Except for slightly higher-than-expected level of scattered light, improvements in which are discussed, the OPOS simulator gives an excellent analog of stellar fields.
GRA

N78-19027*# Planning Research Corp., Washington, D. C.
DESIGN AND DEVELOPMENT OF THE SPACE SHUTTLE TAIL SERVICE MASTS
S. R. Dandage, N. A. Herman, S. E. Godfrey, and R. T. Uda *In* NASA. Goddard Res. Center The 11th Aerospace Mech. Symp. Apr. 1977 p 1-12 refs (For availability see N78-19026 09-99)
Avail: NTIS HC A11/MF A01 CSCL 22D

N78-19044*# Martin Marietta Corp., Orlando, Fla.
THE CONCEPTION, BIRTH, AND GROWTH OF A MISSILE UMBILICAL SYSTEM
Glenn W. Nordman *In* NASA. Goddard Res. Center The 11th Aerospace Mech. Symp. Apr. 1977 p 197-206 ref (For availability see N78-19026 09-99)
Avail: NTIS HC A11/MF A01 CSCL 22D

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N78-18096*# Analytical and Computational Mathematics, Inc., Houston, Tex.
SATELLITE ORBIT COMPUTATION METHODS Final Report
Dec. 1977 27 p refs
(Contract NAS9-15171)
(NASA-CR-151600) Avail: NTIS HC A03/MF A01 CSCL 22A

Mathematical and algorithmical techniques for solution of problems in satellite dynamics were developed, along with solutions to satellite orbit motion. Dynamical analysis of shuttle on-orbit operations were conducted. Computer software routines for use in shuttle mission planning were developed and analyzed, while mathematical models of atmospheric density were formulated.
Author

N78-18097*# National Aeronautics and Space Administration, Washington, D. C.
TECHNICAL CHARACTERISTICS AND WORKING CONDITIONS OF LONG-TERM ORBITING SALYUT-TYPE SPACE STATIONS
Jan. 1978 45 p Transl. into ENGLISH of "Tekhnicheskiye Kharakteristiki i Rabochiye Parametry Dolgovremmenoy Orbitalnoy Stantsii Tipa Salyut" Acad. of Sci. USSR, Moscow, 1977 p 1-42 Transl. by Transemantics, Inc.
(Contract NASw-2792)
(NASA-TM-75058) Avail: NTIS HC A03/MF A01 CSCL 22A

The technical characteristics and working conditions of the Salyut-type orbiting space stations which affect the selection of preliminary versions of scientific programs and the selection of plans in conjunction with space shuttle operations are presented.
Author

N78-18098*# Teledyne Brown Engineering, Huntsville, Ala.
SURVEY: NATIONAL ENVIRONMENTAL SATELLITE SERVICE
Nov. 1977 35 p
(Contract NAS8-32539)
(NASA-CR-150546; SD77-MSFC-2152) Avail: NTIS HC A03/MF A01 CSCL 22A

The national Environmental Satellite Service (NESS) receives data at periodic intervals from satellites of the Synchronous Meteorological Satellite/Geostationary Operational Environmental Satellite series and from the Improved TIROS (Television Infrared Observational Satellite) Operational Satellite. Within the conterminous United States, direct readout and processed products are distributed to users over facsimile networks from a central processing and data distribution facility. In addition, the NESS Satellite Field Stations analyze, interpret, and distribute processed geostationary satellite products to regional weather service activities.
Author

N78-18099# Lincoln Lab., Mass. Inst. of Tech., Lexington.
AN ELECTRO OPTICAL MTI SYSTEM FOR THE DETECTION OF ARTIFICIAL SATELLITES (THE NITH FINDER)
Gerard T. Flynn 27 Jun. 1977 209 p
(Contract F19628-76-C-0002; AF Proj. 2128)
(AD-A048055; TN-1977-32; ESD-TR-77-175) Avail: NTIS HC A10/MF A01 CSCL 15/3

This report describes an electro-optical moving target indicator (MTI) system that was developed for the detection of satellites in deep space. The system operates on standard RS-170 video provided from a telescope mounted TV camera. The principle of operation is to remove stationary clutter background (stars), enhance signal to noise by integration of successive frames and provide automatic detection by means of constant false alarm rate (CFAR) thresholding in combination with majority logic correlation. A detailed description of the theory of operation as well as complete design details are given along with actual field test results.
Author (GRA)

N78-18100# Naval Postgraduate School, Monterey, Calif.
TEST AND EVALUATION FOR AN AIR-LAUNCHED GUIDED MISSILE PROGRAM M.S. Thesis
Kennerly Wendell Funk and Richard Loraine Dec. 1977 143 p refs
(AD-A048675) Avail: NTIS HC A07/MF A01 CSCL 05/1

This thesis evaluates the Navy's test and evaluation (T and E) process for air-launched guided missiles, identifies T and E management problems, and proposes utilization of a particular test program strategy. Many changes have been made to improve the T and E process, but some of these have resulted in costly inefficiencies. Contributing problems include: the operational test agencies do not participate adequately in early test planning, excess duplication exists in testing done by major participants in the Navy air-launched guided missile T and E process, lack of definition of a mission profile leads to improper and inadequate testing of air-launched guided missiles, and numerous other T and E management problems. The utilization of an Integrated Test Program approach for air-launched guided missile T and E is proposed. Test data from contractor demonstration tests, limited TECHEVAL, and OPEVAL would be pooled to confirm compliance with specification requirements and verify operational effectiveness and suitability. Test assets and other resources would be conserved and overall T and E schedule improved.
Author (GRA)

N78-18101# Raytheon Co., Waltham, Mass. Research Div.
HIGH DURABILITY MISSILE DOMES Interim Technical Report, 1 Apr. 1976 - 30 Sep. 1977
R. Gentilman, E. Maguire, and J. Pappis Dec. 1977 53 p
(Contract N00014-76-C-0635)
(AD-A048497; S-2284) Avail: NTIS HC A04/MF A01 CSCL 17/5

Magnesium oxide optical surfaces were protected from degradation due to moisture by any of several sputtered coatings. The coatings are of optical quality and were unaffected by rainfield tests at 256 m/sec. Highly transparent flat plate samples of polycrystalline magnesium aluminum oxide (spinel) were fabricated by the fusion casting technique. The best samples have a 2:1 Al_2O_3 composition and measure more than 50 mm across and

3 mm thick. Beams of polycrystalline and single crystal alumina-rich spinel were deformed in three-point loading at approximately equal to 1750 C. Applied stresses between 20 and 70 MN/sq m produced up to right angle bends, suggesting the feasibility of forging flat plates of spinel into hemispherical dome shapes. Author (GRA)

N78-18102# European Space Agency, Paris (France).
INDEX OF ELDO PUBLICATIONS
Sep. 1977 423 p refs
(ESA-SP-1006) Avail: NTIS HC A18/MF A01

A bibliography is presented of documents produced during the ELDO program, 1963 to 1972. The objective of this program was to produce a European launch facility. The bibliography, covering nearly 2000 citations complete with indexes, was prepared by the ESA Space Documentation Service in collaboration with the ELDO Documentation Group and NASA, the latter providing the computed processing and editing capability. ESA

N78-18103# AEG-Telefunken, Backnang (West Germany).
CONCEPTS FOR THE REALIZATION OF TV BROADCASTING SATELLITE [KONZEPTE FUER DIE REALISIERUNG VON FERNSEHRUNDFUNKSATELLITEN]
Diederich Koehn Sep. 1977 13 p refs In GERMAN Presented at the 26th Space Congr. of the Hermann-Oberth-Ges. e.V., Berlin, 1-4 Sep. 1977
Avail: NTIS HC A02/MF A01

Design concepts for further direct TV broadcasting satellites are described. Topics notably dealt with are: sun-pointing, solar generators to provide the required transmission power of at least 100 W and are EIRP of at least 65 dBW, and the thermal control subsystem requiring modifications in traveling wave tube heat sinks. ESA

N78-19030*# Martin Marietta Aerospace, Denver, Colo.
FLY-AWAY RESTRAINT PIN MECHANISM FOR THE ARMY'S PATRIOT MISSILE SYSTEM
Frederick W. Knight *In* NASA. Goddard Res. Center The 11th Aerospace Mech. Symp. Apr. 1977 p 35-44 (For availability see N78-19026 09-99)
Avail: NTIS HC A11/MF A01 CSCL 16D

N78-19033*# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France). Pyrotechnics Dept.
CARTRIDGE FIRING DEVICE DESIGNED FOR ATTACHMENT, RELEASE AND EJECTION OF A SATELLITE
Lucien Pierron *In* NASA. Goddard Res. Center The 11th Aerospace Mech. Symp. Apr. 1977 p 67-76 (For availability see N78-19026 09-99)
Avail: NTIS HC A11/MF A01 CSCL 22B

N78-19035*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
POSITIVE COMMANDABLE OILER FOR SATELLITE BEARING LUBRICATION
Gordon E. James *In* NASA. Goddard Res. Center The 11th Aerospace Mech. Symp. Apr. 1977 p 87-95 refs (For availability see N78-19026 09-99)
Avail: NTIS HC A11/MF A01 CSCL 22B

N78-19040*# Dornier-System G.m.b.H., Friedrichshafen (West Germany).
THE GEOS-20 m CABLE BOOM MECHANISM
Guenther K. Schmidt and Klaus Suttner *In* NASA. Goddard Res. Center The 11th Aerospace Mech. Symp. Apr. 1977 p 147-156 refs (For availability see N78-19026 09-99)
Avail: NTIS HC A11/MF A01 CSCL 22B

N78-19043*# Societe Nationale Industrielle Aerospatiale, Paris (France).
DEVELOPMENT OF A SATELLITE FLYWHEEL FAMILY OPERATING ON ONE ACTIVE AXIS MAGNETIC BEARINGS
Pierre C. Poubeau *In* NASA. Goddard Res. Center The 11th Aerospace Mech. Symp. Apr. 1977 p 179-195 ref Sponsored in part by INTELSAT, ESA, and CNES (For availability see N78-19026 09-99)
Avail: NTIS HC A11/MF A01 CSCL 22B

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N78-18104*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
IUS PRERELEASE ALIGNMENT
F. A. Evans Jan. 1978 96 p refs
(NASA-TM-79349; JSC-78-FM-3; JSC-13838) Avail: NTIS HC A05/MF A01 CSCL 22B

Space shuttle orbiter/IUS alignment transfer was evaluated. Although the orbiter alignment accurary was originally believed to be the major contributor to the overall alignment transfer error, it was shown that orbiter alignment accuracy is not a factor affecting IUS alignment accuracy, if certain procedures are followed. Results are reported of alignment transfer accuracy analysis. B.L.P.

N78-18105*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN INTRODUCTION TO SHUTTLE/LDEF RETRIEVAL OPERATIONS: THE R-BAR APPROACH OPTION
William M. Hall Feb. 1978 180 p
(NASA-TM-78668) Avail: NTIS HC A09/MF A01 CSCL 22A

Simulated orbiter direct approaches during long duration exposure facility (LDEF) retrieval operations reveal that the resultant orbiter jet plume fields can significantly disturb LDEF. An alternate approach technique which utilizes orbital mechanics forces in lieu of jets to brake the final orbiter/LDEF relative motion during the final approach, is described. Topics discussed include: rendezvous operations from the terminal phase initiation burn through braking at some standoff distance from LDEF, pilot and copilot activities, the cockpit instrumentation employed, and a convenient coordinate frame for studying the relative motion between two orbiting bodies. The basic equations of motion for operating on the LDEF radius vector are introduced. Practical considerations of implementing an R-bar approach, namely, orbiter/LDEF relative state uncertainties and orbiter control system limitations are explored. A possible R-bar approach strategy is developed and demonstrated. Author

N78-18106# Committee on Science and Technology (U. S. House).
SPACE SHUTTLE, 1978
Washington GPO 1978 535 p refs Status rept. for Comm. on Sci. and Technol., 95th Congr., 2d Sess., Jan. 1978
(GPO-99-072) Avail: SOD

A status report is presented to provide the members of the Committee on Science and Technology and the Subcommittee on Space Science and Applications with source material addressing the current issues associated with cost, performance, and schedule of the NASA Space Shuttle program, prior to the fiscal year 1979 NASA Authorization hearings. Author

N78-18107# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Lampoldshausen (West Germany). Inst. fuer Chemische Raketenantriebe.
PRELIMINARY DESIGN STUDY OF A PROPULSION PLATFORM FOR TRANSPORT OF SPACELAB PAYLOADS [VORSTUDIE FUER DEN ENTWURF EINER ANTRIEBSPLATTFORM ZUM TRANSPORT VON SPACELAB-NUTZLASTEN]
Juergen Broschk Jan. 1976 33 p refs In GERMAN
(DLR-IB-456/76-6) Avail: NTIS HC A03/MF A01

The design of the propulsion system for a Spacelab payload transportation platform is considered. A number of Spacelab experiments require an auxiliary propulsion system in order to carry out missions outside Spacelab's near vicinity. A universally deployable platform has been proposed for this purpose, allowing transportation of single experiment units and the transport and positioning of satellites. To satisfy the requirement of universal applicability the platform should cover a wide range of propulsive power to cater to speeds of 100 m/s up to some km/s, and be modifiable with little qualification effort. ESA

N78-18108# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Lampoldshausen (West Germany).
SEAP - CONFIGURATION AND COST ANALYSIS [SEAP - KONFIGURATIONS- UND KOSTENANALYSE]
D. Manski and L. Witbracht Jan. 1977 65 p refs In GERMAN Report will also be announced as translation (ESA-TT-456)
(DLR-IB-456-77/2) Avail: NTIS HC A05/MF A01

An analysis of 26 different Spacelab experiment propulsion platform configurations is presented covering the determination of costs, mass, and the required volume in the shuttle payload bay. As a result of this analysis, three preferred configurations were selected: (1) hydrazine, super blowdown, isotensoid tank; (2) hydrazine, blowdown, inert gas attitude control, spherical tank; and (3) hydrazine, regulated pressurized gas system, inert gas attitude control, spherical tank. ESA

N78-18109# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Lampoldshausen (West Germany).
SEAP: A SPACELAB EXPERIMENTS PROPULSIVE PLATFORM FOR THE TRANSPORT OF SPACELAB PAYLOADS. FIRST STUDY RESULTS [SEAP - EINE SPACELAB-EXPERIMENTEN-ANTRIEBSPLATTFORM FUER DEN TRANSPORT VON SPACELAB NUTZMASSEN. ERSTE STUDIENERGEBNISSE]
T. Lange, D. Manski, R. Naehle, M. Piening, S. G. Rosen, H. P. Schmidt, and G. S. Shau Jan. 1976 85 p refs In GERMAN Report will also be announced as translation (ESA-TT-460)
(DLR-IB-456-76/1) Avail: NTIS HC A05/MF A01

The possibility of using a propulsive platform for the transport of Spacelab payloads was investigated. Topics dealt with include system analytical considerations on the concept of a Spacelab Experiments Propulsive Platform (SEAP) and a description and an analysis of the SEAP subsystems, such as the propulsive system, orbits and performance, attitude control, energy housekeeping, and power supply. ESA

N78-18110# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Lampoldshausen (West Germany). Inst. fuer Chemische Raketenantriebe.
THE MAIN PROPULSION SYSTEM OF THE U.S. SPACE SHUTTLE. AN EXAMPLE OF THE PERFORMANCE INCREASE OF PROPULSION SYSTEMS OF SINGLE STAGE LAUNCH ROCKETS [DAS HAUPTTRIEBWERK DES US-RAUMTRANSPORTERS. EIN BEISPIEL FUER DIE LEISTUNGSSTEIGERUNG BEI TRIEBWERKEN EISTUFIGER TRAEGERRAKETEN]
Robert H. Schmucker 1976 40 p refs In GERMAN Presented at the DGLR Meeting on Chem. Propulsion, Ottobrunn, West Ger., 18-19 Mar. 1976 Sponsored partly by U.S. Natl. Res. Council and partly by Deut. Forschungsgemeinschaft Report will also be announced as translation (ESA-TT-461)
(DLR-IB-76-3) Avail: NTIS HC A03/MF A01

The U.S. Space Shuttle Main Engine (SSME) is discussed. Single stage launch vehicles with low payload in comparison to the takeoff mass are very sensitive to the specific impulse performance of the propulsion engine, which should therefore be maximized. The average available impulse depends on the mixing behavior of the propellant combination, on the combustion chamber pressure, surface ratio, propellant supply system, and nature of the ascent orbit, and on losses in the combustion chamber and in the expansion nozzle. The various criterions for the design of single stage launch vehicles are given and the nozzle geometry requirements are presented. The technical implementation is exemplified with the SSME, of which the main construction elements and data are given. Using available experimental values of existing propulsion systems, a critical evaluation of the performance increase that can be obtained by using high pressure technology was made. ESA

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

N78-18111# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
ROOFTOP ANTENNA POINTING PROGRAM Final Report, Mar. 1974 - Oct. 1977
Paul F. Humel Nov. 1977 143 p refs
(AF Proj. 1227)
(AD-A047999; AFAL-TR-77-228) Avail: NTIS HC A07/MF A01 CSCL 17/2

This document provides a description of the in-house work performed in the Air Force Avionics Laboratory's Communication Systems Evaluation Laboratory (CSEL) to successfully point a ten-foot dish antenna at any earth orbiting satellite for which ephermeris data is available. Both the hardware and software aspects of the program are covered. Author (GRA)

N78-18112# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
TEST FACILITY FOR TELEVISION SENSORS APPLIED TO THE DETECTION OF SATELLITES Final Report, May 1972 - May 1975
Peter L. Manly Sep. 1977 54 p refs
(AD-A048189; AFAL-TR-77-185) Avail: NTIS HC A04/MF A01 CSCL 17/8

A facility was established to demonstrate the adequacy of 1973-1974 state-of-the art television sensors to detect faint spacecraft so as to confirm that technology would be available for a new generation of optical surveillance cameras. This facility is described in detail and the detail and the results discussed of testing an ebsicon Silicon Intensified Target Camera system, along with associated MTI devices, for detection of stellar and satellite sources. Author (GRA)

N78-18113# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A USERS GUIDE TO THE GEODSS REAL-TIME SYSTEM Project Report
Susan N. Landon Nov. 1977 53 p refs
(Contract F19628-78-C-0002; AF Proj. 2128)
(AD-A048300; ETS-24; ESD-TR-77-274) Avail: NTIS HC A04/MF A01 CSCL 17/8

The following guide describes the GEODSS Real-Time and simulated system from the standpoint of the operator. Included are descriptions of system messages, operator inputs and options, and error conditions and recovery procedures. Much of the system is controlled by programmable buttons, and diagrams of their locations and functions are included in the appendix. The Real-Time System runs on a MODCOMP IV computer with 128K of core. It gives the operator control of one of two 31-inch optical telescopes in the automatic search/track or manual modes. The automatic modes are used for locating and tracking satellites. To aid in finding them, various scan patterns are available, which may be superimposed on the basic tracking of the telescope. The operator may also control the telescope manually at rates ranging from a few seconds of arc to four degrees per second. Calibration and calibration checking are two other features of this system. Magnetic tape recording, line printer output and a metric observation file log the metric data. Target identification assistance is provided by a program that lists all known satellites within five degrees. A satellite scheduling program may be used to automate scheduling. An SOI data collection capability is also available. Author (GRA)

N78-18114# Thomson-CSF, Meudon-la-Foret (France). Div. D.F.H.
PSK DEMODULATOR. STUDY REPORT ON A DEMODULATOR FOR ONBOARD TELEMETRY DECODER [DEMODULATEUR PSK. RAPPORT D'ETUDE D'UN DEMODULATEUR POUR UN DECODEUR DE TELECOMMANDE EMBARQUE]

G. Leveque and R. Riboni Paris ESA Jun. 1977 330 p refs Partly in FRENCH and partly in ENGLISH; ENGLISH summary (Contract ESTEC-2525/75-HP(SC))
(ESA-CR(P)-968) Avail: NTIS HC A15/MF A01

Problems associated with the suppression of the clock signal from PCM telemetry signals were investigated with regard to subcarrier and bit timing recovery together with squelch information recovery. The data acquisition and time needed for acquisition characteristics are detailed in regard to clock frequency and subcarrier reconstruction together with filtering out the link noise. The performance of a phase loop to filter out the noise was evaluated by computerized simulation. Band commutation of the phase loop is shown to significantly reduce the hang up phenomenon. A complete demodulator structure is proposed and its performances are estimated. ESA

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N78-18115# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Lampoldshausen (West Germany). Inst. fuer Chemische Antriebe und Verfahrenstechnik.
ROCKET STAGE MASS MODEL FOR PERFORMANCE PREDICTION
Robert H. Schmucker and Harry O. Ruppe (Tech. Univ. Munich) 1977 40 p refs Presented at the 26th Congr. of the Intern. Astron. Federation, Lisbon, 21-27 Sep. 1975
(DLR-IB-456-75/8) Avail: NTIS HC A03/MF A01

Preliminary vehicle design requires prediction of both specific impulse and stage net mass. At present, specific impulse calculation including various losses can be accomplished within a narrow margin of a few seconds by use of reliable theoretical and empirical data. The situation with vehicle net mass is different, since mass prediction is much more complicated. A new mass model for stage net mass is presented which is based on analytical correlations for the major vehicle masses and numerical fit of various parameters to existing and advanced stages. This model is applied for various selected propellants, mixed or dual propellant made to give stage performance prediction and characterization of advanced missions. A sensitivity analysis points out the limitation of a realistic prediction or design.
Author (ESA)

N78-18116# European Space Research and Technology Center, Noordwijk (Netherlands). Product Assurance Div.
GUIDELINES FOR SPACE MATERIALS SELECTION
Paris ESA Jul. 1977 84 p refs
(ESA-PSS-07/QRM-01-Issue-3) Avail: NTIS HC A05/MF A01

Different classes of material used in spacecraft manufacture are reviewed; their chemical nature and physical aspects are described and some consideration is given to their processing and assembly methods. Precautions to be taken and material to be avoided are emphasized for each class. General effects of the space environment are also described. Some individual materials suitable for space application under certain conditions are mentioned. Author (ESA)

N78-19036*# Martin Marietta Corp., Denver, Colo.
DOCKING AND RETRIEVAL MECHANISM
J. Robert Tewell and Richard A. Spencer *In* NASA. Goddard Res. Center The 11th Aerospace Mech. Symp. Apr. 1977 p 101-110 refs (For availability see N78-19026 09-99)
(Contract NAS8-31290)
Avail: NTIS HC A11/MF A01 CSCL 22B

N78-19039*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN ACTIVE NUTATION DAMPER FOR SPACECRAFT
Richard A. Abercrombie and Thomas W. Flatley *In its* The 11th Aerospace Mech. Symp. Apr. 1977 p 133-145 (For availability see N78-19026 09-99)
Avail: NTIS HC A11/MF A01 CSCL 22A

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N78-18117*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
OPTIMIZATION OF THE DESIGN PARAMETERS FOR A WIDE-BAND RADIOMETRIC SYSTEM
Pradeep K. Agrawal (Joint Inst. for Advan. of Flight Sci., Hampton, Va.) Jan. 1978 25 p refs
(NASA-TM-78662) Avail: NTIS HC A02/MF A01 CSCL 14C

The optimun design parameters for a swept frequency wide-band radiometric antenna system for spacecraft applications are studied. Wide band antenna systems are needed to observe layered surfaces which are frequency sensitive and require multiple measurements for interpretation. The lowest frequency band of interest is between 1.4 to 2.8 Ghz. Starting with a given size reflector fed in the offset mode by a corrugated horn located at the focus of the parabola, the primary performance indexes; e.g., half power beamwidth, cross polarization level, and overall beam efficiency were calculated over a wide frequency range (two to one) for different physical horn dimensions and for different values of f/D ratio. These data are used to find the best design under given restriction of reflector size and blockage. Author

N78-18118*# Axiomatix, Marina del Rey, Calif.
SPACE SHUTTLE PROXIMITY OPERATION SENSOR STUDY Final Report
Charles L. Weber and Waddah K. Alem 15 Feb. 1978 131 p refs
(Contract NAS9-15502)
(NASA-CR-151634; Axiomatix-R7802-2) Avail: NTIS HC A07/MF A01 CSCL 22B

The performance of the Kuband radar was analyzed in detail, and the performance was updated and summarized. In so doing, two different radar design philosophies were described, and the corresponding differences in losses were enumerated. The resulting design margins were determined for both design philosophies and for both the designated and nondesignated range modes of operation. In some cases, the design margin was about zero, and in other cases it was significantly less than zero. With the point of view described above, the recommended solution is to allow more scan time but at the present scan rate. With no other changes in the present configuration, the radar met design detection specifications for all design philosophies at a range of 11.3 nautical miles. Author

N78-19029*# Hughes Aircraft Co., Culver City, Calif.
MAGNETOMETER DEPLOYMENT MECHANISM FOR PIONEER VENUS
William L. Townsend *In* NASA. Goddard Res. Center The 11th Aerospace Mech. Symp. Apr. 1977 p 23-33 (For availability see N78-19026 09-99)
(Contract NAS2-8300)
Avail: NTIS HC A11/MF A01 CSCL 14B

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N78-18119*# Rocketdyne, Canoga Park, Calif.
TRIPROPELLANT ENGINE STUDY Bimonthly Progress Report
D. B. Wheeler 9 Feb. 1978 49 p
(Contract NAS8-32613)
(NASA-CR-150562; ASR78-17; BMPR-3) Avail: NTIS HC A03/MF A01 CSCL 21H

Engine performance data, combustion gas thermodynamic properties, and turbine gas parameters were determined for various high power cycle engine configurations derived from the space shuttle main engine that will allow sequential burning of LOX/hydrocarbon and LOX/hydrogen fuels. Both stage combustion and gas generator pump power cycles were considered. Engine concepts were formulated for LOX/RP-1, LOX/CH4, and LOX/C3H8 propellants. Flowrates and operating conditions were established for this initial set of engine systems, and the adaptability of the major components of shuttle main engine was investigated. Author

N78-18120*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ION PROPULSION MODULE (IPM) TECHNOLOGY READINESS ASSESSMENT: 1985 HALLEY'S COMET RENDEZVOUS MISSION
John West 15 Jul. 1977 19 p Sponsored by NASA
(NASA-CR-155308) Avail: NTIS HC A02/MF A01 CSCL 21C

An assessment of the risk of utilizing ion propulsion to perform a rendezvous mission with Halley's comet in 1985 is presented, and consideration recommendations for reducing identified risks to the lowest possible level at project start in October 1978 were made. Author

N78-18121# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Lampoldshausen (West Germany). Inst. fuer Chemische Antriebe und Verfahrenstechnik.
ROCKET GAS GENERATORS - TERRESTRIAL USE OF SPACE TECHNOLOGY [RAKETENGASERZEUGER - TERRESTRISCHE ANWENDUNG VON RAUMFAHRTTECHNOLOGIE]
Robert H. Schmucker Dec. 1976 33 p refs In GERMAN Presented at the Seminar for Flugwesen und Weltraumforsch., Tech. Univ. Munich, 1976/1977
(DLR-IB-456-76/9) Avail: NTIS HC A03/MF A01

Gas generators based on rocket engines, either as heat exchangers or by direct generation in a burner, are considered as spin-off from space technology. Alternative methods for gas generation and applications are described as a function of the characteristic properties of the rocket engine. Three promising applications are discussed: air heating for test operations, working gas generation for a gas dynamic CO2 laser, and hot steam production for power plants. ESA

N78-18122# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Lampoldshausen (West Germany). Inst. fuer Chemische Antriebe und Verfahrenstechnik.
LITHERGOL DUAL PROPULSION FOR CRUISE MISSILES [LITHERGOLE DUALANTRIEBE FUER MARSCHFLUGKOERPER]
Hendrik R. Lips and Robert H. Schmucker Sep. 1976 42 p refs In GERMAN Presented at the Meeting of the DFLR-Fachausschuss Luftatmende Flugkoerperantriebe, Brunswick, 27-28 Sep. 1976 Report will also be announced as translation (ESA-TT-446)
(DLR-IB-76-7) Avail: NTIS HC A03/MF A01

Construction, functioning, and specific characteristics of lithergol propulsive systems - rockets and air breathing engines - in missiles are reviewed. It is shown that for cruise missiles a variety of combination propulsive engines are possible. Considering aspects such as performance, it is concluded that none of these aspects will pose insurmountable problems. ESA

N78-18123# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Lampoldshausen (West Germany). Inst. fuer Chemische Raketenantriebe.
USAP - A UNIVERSAL STANDARDIZED PROPULSION PLATFORM FOR THE TRANSPORT OF SPACELAB PAYLOADS [USAP - EINE UNIVERSELLE STANDARDISIERTE ANTRIEBSPLATTFORM ZUM TRANSPORT VON SPACELAB-NUTZLASTEN]
Detlef Manski, Joachim Nitsch, and Stanley G. Rosen 20 Nov. 1975 32 p refs In GERMAN Presented at DFVLR - Arbeitssitzung: Spacelab-Nutzung, Porz-Wahn, West Ger., 10 Dec. 1974, and at Colloq. on Transfer Technol., Bundesmin. fuer Forsch. u. Technol., 5 Feb. 1975 Report will also be announced as translation (ESA-TT-455)
(DLR-IB-456/75-9) Avail: NTIS HC A03/MF A01

A proposal is presented for a Spacelab payload transportation system to accomodate a number of Spacelab experiments requiring an auxiliary propulsion system to carry out missions outside Spacelab's near vicinity. A universally deployable platform is proposed for this purpose allowing transportation of single experiment units as well as the transport and positioning of satellites. ESA

N78-18124# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Lampoldshausen (West Germany). Inst. fuer Chemische Antriebe und Verfahrenstechnik.
USE OF FLUID INJECTION TO REGULATE THE COMBUSTION CHAMBER PRESSURE FOR UNSTABLY BURNING SOLID PROPELLANT COMBUSTION
Robert H. Schmucker and Hendrik R. Lips Jul. 1977 18 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-457)
(DLR-IB-456-77/4) Avail: NTIS HC A02/MF A01

Solid propellants having a pressure exponent greater than 1 cannot be used in a rocket engine without additional modifications. Liquid injection represents a method to stabilize the combustion. The relationships between the operating point, stability, and the operation are derived. The stability limit for quasi-steady operation was investigated, and the influence of dynamic effects on the combustion pressure characteristics presented. Author (ESA)

N78-18125# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Lampoldshausen (West Germany). Inst. fuer Chemische Raketenantriebe.
PROGRAM LISTING OF AN ANALYTIC MASS MODEL FOR CHEMICAL ROCKET STAGES [PROGRAMMLISTE EINES ANALYTISCHEN MASSENMODELLS CHEMISCHER RAKETENSTUFEN]
Maurice M. Bunn, Juergen Broschk, and Detlef Manski Jan. 1976 44 p refs In GERMAN
(DLR-IB-456-76/2) Avail: NTIS HC A03/MF A01

The main program and subroutines are listed for mass simulation and dimensioning of chemical geosynchronous kick stage apogee systems of various configurations. Author (ESA)

N78-18126# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Lampoldshausen (West Germany). Inst. fuer Chemische Raketenantriebe.
HYBRID PROPULSIVE SYSTEMS: TECHNOLOGY AND APPLICATION [HYBRIDTRIEBWERKE: TECHNOLOGIE UND ANWENDUNG]
Robert H. Schmucker and Hendrik R. Lips 1976 64 p refs In GERMAN Presented at the CCG Seminary 'Chem. Raketenantriebe in Raumfahrt u. Wehrtech., Lampoldshausen, West Ger., 6-8 Apr. 1976 Report will also be announced as translation (ESA-TT-448)
(DLR-IB-456-76/11) Avail: NTIS HC A04/MF A01

Hybrid propulsive systems ranging from the classical lithergol propulsive system with solid propellant and liquid oxidator via air breathing hybrid propulsive systems to solid propellant engines with liquid injection were compared. For the performance comparison some propellant combinations were prepared. The combustion processes were analyzed, and experimental combustion phenomenons and theoretical combustion investigations are discussed. The internal ballistics aspects, ignition, quasi-stationary

and time dependent operational point and thrust variation are also dealt with. The various essential elements of the hybrid engine and the required technology - injection nozzle, rocket charges, mixing chamber - are dealt with. ESA

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N78-18127*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TOXICITY OF PYROLYSIS GASES FROM SYNTHETIC POLYMERS
Carlos J. Hilado (San Francisco Univ.), Jeanne A. Soriano (San Francisco Univ.), Kay L. Kosola (San Francisco Univ.), Demetrius A. Kourtides, and John A. Parker Dec. 1977 26 p refs
(NASA-TM-78458; A-7297) Avail: NTIS HC A03/MF A01 CSCL 06T

The screening test method was used to investigate toxicity in polyethylene, polystyrene, polymethyl methacrylate, polyaryl sulfone, polyether sulfone, polyphenyl sulfone, and polyphenylene sulfide. Changing from a rising temperature program to a fixed temperature program resulted on shorter times to animal responses. This effect was attributed in part to more rapid generation of toxicants. The toxicants from the sulfur containing polymers appeared to act more rapidly than the toxicants from the other polymers. It was not known whether this effect was due primarily to difference in concentration or in the nature of the toxicants. The carbon monoxide concentration found did not account for the results observed with the sulfur containing polymers. Polyphenyl sulfone appeared to exhibit the least toxicity among the sulfur containing polymers evaluated under these test conditions. Author

N78-18128# National Bureau of Standards, Washington, D. C. Inst. for Materials Research.
METHODS AND STANDARDS FOR ENVIRONMENTAL MEASUREMENT. PROCEEDINGS OF THE MATERIALS RESEARCH SYMPOSIUM Final Report
William H. Kirchhoff Nov. 1977 653 p refs Symp. held at Gaithersburg, Md., 20-24 Sep. 1976
(PB-275008/1; NBS-SP-464; LC-76-608384) Avail: NTIS HC A99/MF A01 CSCL 07D

Extended abstracts of the invited and contributed papers on topics of concern at the symposium were presented. Some topics discussed were: (1) the analysis of trace organic compounds in water; (2) multielement analysis; (3) the physical and chemical characterization of aerosols; (4) the application of laser technology to atmospheric monitoring; and (5) ambient air quality monitoring. The chemical characterization of inorganic and organometallic constituents was also discussed. Author

N78-18129# Auerbach Associates, Inc., Philadelphia, Pa.
CHEMICAL USE CLASSIFICATION SYSTEM Final Report, Jul. 1976 - Oct. 1977
Wendy L. Byer Oct. 1977 184 p
(PB-275106/3; EPA-560/9-77-001) Avail: NTIS HC A09/MF A01 CSCL 13B

The classification System allows manufacturers, processors and importers of chemicals to report chemical use data to EPA in a form that will facilitate analysis. This system includes a use classification scheme, an alphabetical index to the classification scheme, instructions describing how to report chemical use, production and exposure information, and a reporting form on which to code the above information. GRA

24 COMPOSITE MATERIALS

Includes laminates.

N78-18130 Florida Univ., Gainesville.
THE CHEMICAL, MECHANICAL, AND IMPLANT PROPERTIES OF GLASS-COATED ALUMINA Ph.D. Thesis
David Charles Greenspan 1977 215 p
Avail: Univ. Microfilms Order No. 77-29246

A prosthetic implant system is developed which utilizes a surface reactive glass known to bond to living bone as a coating on high strength, fully dense alumina. Processing procedures which result in bonding of the glass coating to the alumina are established. Electron microprobe studies show a large interfacial zone due to the diffusion of Al ions from the alumina into the glass and alkali ions from the glass into the alumina. This interfacial zone is found to be quite sensitive to the time and temperature at which the glass coating is fired onto the alumina. Methods for processing multiple layers of glass onto the alumina are also developed. Dissert. Abstr.

N78-18131*# Fiber Science, Inc., Gardena, Calif.
COMPOSITE HUB/METAL BLADE COMPRESSOR ROTOR Contractor Report, Dec. 1974 - Oct. 1975
Sam Yao Jan. 1978 25 p
(Contract NAS3-18926)
(NASA-CR-135343) Avail: NTIS HC A02/MF A01 CSCL 11D

A low cost compressor rotor was designed and fabricated for a small jet engine. The rotor hub and blade keepers were compression molded with graphite epoxy. Each pair of metallic blades was held in the hub by a keeper. All keepers were locked in the hub with circumferential windings. Feasibility of fabrication was demonstrated in this program. Author

N78-18132*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
A NEW EXPERIMENTAL METHOD FOR THE ACCELERATED CHARACTERIZATION OF COMPOSITE MATERIALS Interim Report
Y. T. Yeow, D. H. Morris, and H. F. Brinson Mar. 1978 30 p refs
(Grant NsG-2038)
(VPI-E-78-3; NASA-CR-155785) Avail: NTIS HC A03/MF A01 CSCL 11D

The use of composite materials for a variety of practical structural applications is presented and the need for an accelerated characterization procedure is assessed. A new experimental and analytical method is presented which allows the prediction of long term properties from short term tests. Some preliminary experimental results are presented. Author

N78-18133*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THIRD CONFERENCE ON FIBROUS COMPOSITES IN FLIGHT VEHICLE DESIGN, PART 1
Washington Apr. 1976 497 p refs Conf. held at Williamsburg, Va., 4-6 Nov. 1975
(NASA-TM-X-3377-Pt-1; L-10640-Pt-1) Avail: NTIS HC A21/MF A01 CSCL 11D

The use of fibrous composite materials in the design of aircraft and space vehicle structures and their impact on future vehicle systems are discussed. The topics covered include: flight test work on composite components, design concepts and hardware, specialized applications, operational experience, certification and design criteria. Contributions to the design technology base include data concerning material properties, design procedures, environmental exposure effects, manufacturing procedures, and flight service reliability. By including composites as baseline design materials, significant payoffs are expected in terms of reduced structural weight fractions, longer structural life, reduced fuel consumption, reduced structural complexity, and reduced manufacturing cost. Author

N78-18134*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THIRD CONFERENCE ON FIBROUS COMPOSITES IN FLIGHT VEHICLE DESIGN, PART 2
Washington Apr. 1976 395 p refs Conf. held at Williamsburg, Va., 4-6 Nov. 1975
(NASA-TM-X-3377-Pt-2; L-10640-Pt-2) Avail: NTIS HC A17/MF A01 CSCL 11D
For abstract, see N78-18133.

N78-18135*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TENSILE STRESS-STRAIN BEHAVIOR OF BORON/ALUMINUM LAMINATES
J. A. Sova (Joint Inst. for Advan. of Flight Sci., Hampton, Va.) and C. C. Poe, Jr. Feb. 1978 65 p refs
(NASA-TP-1117; L-11864) Avail: NTIS HC A04/MF A01 CSCL 11D

The tensile stress-strain behavior of five types of boron/aluminum laminates was investigated. Longitudinal and transverse stress-strain curves were obtained for monotonic loading to failure and for three cycles of loading to successively higher load levels. The laminate strengths predicted by assuming that the zero deg plies failed first correlated well with the experimental results. The stress-strain curves for all the boron/aluminum laminates were nonlinear except at very small strains. Within the small linear regions, elastic constants calculated from laminate theory corresponded to those obtained experimentally to within 10 to 20 percent. A limited amount of cyclic loading did not affect the ultimate strength and strain for the boron/aluminum laminates. The laminates, however, exhibited a permanent strain on unloading. The Ramberg-Osgood equation was fitted to the stress-strain curves to obtain average curves for the various laminates. Author

N78-18136# Naval Weapons Center, China Lake, Calif.
TEMPERATURE DEPENDENCE OF THE DIELECTRIC CONSTANT OF QUARTZ POLYMIDE Final Report
James W. Battles and Karl D. Kuehn Dec. 1977 11 p
(AD-A047850; NWC-TP-5983) Avail: NTIS HC A02/MF A01 CSCL 11/2

A Doppler generator was used to measure the complex dielectric constant of quartz polymide at 35 GHz from room temperature to 840 F (450 C). Author (GRA)

N78-18137# Avco Systems Div., Wilmington, Mass.
STRUCTURAL ANALYSIS AND TESTING FOR COMPOSITE FLYWHEEL DEVELOPMENT Final Report, 24 Jan. - 3 Sep. 1977
Donald E. Johnson Sep. 1977 72 p
(Contract DAAG46-77-C-0017)
(AD-A048076) Avail: NTIS HC A04/MF A01 CSCL 13/9

Several effects that can limit the performance of bi-directionally reinforced composite flywheels are investigated. These effects include potential shear failures, degraded properties and variations caused by manufacturing. Finite element analyses are used to determine both the in-plane and interlaminar shear stresses that arise from the discreteness of the individual radial reinforcements. The degradation of material properties due to high biaxial stress levels, especially a drop in shear modulus, is also investigated. Degraded properties are obtained experimentally and used in the evaluation of flywheel performance. Also included is an analysis to determine the feasibility of a static simulation test. In addition, the effect of asymmetric material property variation on flywheel imbalance was investigated. Author (GRA)

N78-18138# SRI International Corp., Menlo Park, Calif.
EXPLORATORY DEVELOPMENT OF CONDUCTIVE COATING MATERIALS Final Report, 15 Mar. 1976 - 15 Mar. 1977
S. R. Morrison, M. Landstrass, and D. B. Parkinson Wright-Patterson AFB, Ohio AFML Jun. 1977 60 p refs
(Contract F33615-76-C-5072)
(AD-A048253; AFML-TR-77-90) Avail: NTIS HC A04/MF A01 CSCL 11/3

The object of this study is the development of a conductive white coating (paint) primarily for use on aircraft radomes. Two problems are addressed. First, in order to maintain a low pigment volume concentration (PVC) so the coating will have good erosion resistance, we have examined ways of inducing the pigment to flocculate in a chain or snowflake structure. This structure is needed to maintain interparticle contacts, and thus high conductance, while permitting a low PVC. The most effective way found to induce chain flocculation was with an applied electric field. With the flocs thus formed, they were cemented into permanent units with a SiCl4 treatment. The second problem examined was the preparation of a white pigment with a stable conductance showing resistance to oxidation. It is pointed out that more work on this latter problem is needed before a completely satisfactory paint is developed. GRA

N78-18139# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
STRESS FIELDS IN COMPOSITE LAMINATES Interim Report, Apr. 1976 - Apr. 1977
N. J. Pagano Aug. 1977 54 p refs
(AD-A048565; AFML-TR-77-114) Avail: NTIS HC A04/MF A01 CSCL 11/4

A new theory is proposed to define the complete stress field within an arbitrary composite laminate. The theory is based upon and extension of Reissner's variational principle to laminated bodies. Weaknesses in previous laminate theories are discussed and it is demonstrated how these are overcome in the present formulation. Comparison with existing numerical elasticity solutions for a class of boundary value problems in which steep stress gradients are present shows extremely close agreement. Author (GRA)

N78-18140# IIT Research Inst., Chicago, Ill.
BIAXIAL TESTING OF GRAPHITE/EPOXY COMPOSITES CONTAINING STRESS CONCENTRATIONS, PART 2 Final Report, 1 Apr. 1976 - 31 Mar. 1977
I. M. Daniel Jun. 1977 172 p refs
(Contract F33615-76-C-5162)
(AD-A048659; AFML-TR-76-244-Pt-2) Avail: NTIS HC A08/MF A01 CSCL 11/4

The objective of the program was to study experimentally the deformation and failure under biaxial tensile loading of graphite/epoxy plates containing circular holes and cracks of various sizes and to determine the influence of notch size on failure. The first phase of this program described in a recent report was limited to quasi-isotropic graphite/epoxy laminates. The program consisted of testing uniaxial unnotched and notched specimens and biaxial notched specimens. The approach used was to measure deformations by means of experimental strain analysis techniques, an determine strain concentrations, strain distributions and variations to failure, failure modes and strength reduction ratios. Whenever possible results were compared with analytical predictions. The objective of the second phase of this investigation described in this final report was to further study experimentally the deformation and failure of graphite/epoxy plates with stress concentrations. GRA

N78-18141# Lehigh Univ., Bethlehem, Pa. Inst. for Metal Forming.
COMPOSITES-ANALYSIS OF NON-HOMOGENEOUS DEFORMATION OF COMPOSITE MATERIALS Final Report, 15 May 1974 - 30 Sep. 1977
Betzalel Avitzur Nov. 1977 83 p refs
(Grants DAHC04-74-G-0167; DAAG29-76-G-0248; DAA29-76-G-0248)
(AD-A048430; ARO-11673.5-E) Avail: NTIS HC A05/MF A01 CSCL 20/11

Environmental pressure, inclusions, and holes have pronounced effect on the strength and ductility of metals. A common test for measuring strength and ductility is the tensile test. A model of a matrix with inclusions and holes is used to obtain an upper-bound solution for the expected strength of the composite. One hypothesis, accepted for this study, is that holes in the interior may be created because of the nonuniformity or nonhomogeneity of the material, these holes being forerunners of final failure. Particular attention is devoted in this study to the prediction of the behavior of the particles and to the growth of pores or prevention of opening of pores. Thus, not only the expected strength of a composite is studied but also the amount of damage imposed by plastic deformation (through the growth of holes) and the prevention of damage during plastic deformation. Author (GRA)

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N78-18142 Washington Univ., Seattle.
VIDEO FLUOROMETRY: A NOVEL APPROACH TO THE ACQUISITION AND INTERPRETATION OF MULTICOMPONENT FLUORESCENCE DATA Ph.D. Thesis
Isiah Manuel Warner 1977 212 p
Avail: Univ. Microfilms Order No. 77-26877

This instrument is capable of acquiring up to 241 fluorescence spectra, taken at up to 241 different exciting wavelengths in 16.7 milliseconds. The results can be displayed in a three-dimensional graphical format in real time. Two types of data reduction strategies are presented: a least squares and linear programming fit to the data, using the spectra of previously determined compounds likely to be present; and a determination of the eigenvalues and eigenvectors of the fluorescence matrix, from which the number of components and the possible spectra of each can be estimated. Computer simulations of the least squares fitting algorithms show that concentrations of five strongly overlapping components should be determinable in the presence of noise to an accuracy of better than 5%. Dissert. Abstr.

N78-18143 Wisconsin Univ., Madison.
AN EXPERIMENTAL DETERMINATION OF THE HISTORY OF FORMATION OF THE CYLINDER AVERAGED OXIDES OF NITROGEN IN DIESEL COMBUSTION Ph.D. Thesis
Ion Alexandru Voiculescu 1977 199 p
Avail: Univ. Microfilms Order No. 77-17858

A method was devised for rapidly discharging and quenching of the cylinder charge during the combustion period at a predetermined crankangle. Once out of the cylinder and cooled down, the gas can be analyzed and the NO and NO sub x concentrations determined. This technique was called dumping and consists mainly in rapidly connecting a large secondary chamber to the combustion chamber by rupturing a diaphragm that separates them. Upon breaking the diaphragm, the high pressure and high temperature gas experiences a rapid expansion into the quenching chamber. The expansion process and mixing with the inert gas cools down the dumped gas causing chemical reaction to cease. Data were taken using an open chamber, four stroke diesel engine with a head modified to accommodate the dumping device. Dissert. Abstr.

N78-18144 Purdue Univ., Lafayette, Ind.
INITIAL AND FINAL STATE EFFECTS IN AUGER AND X-RAY PHOTOELECTRON SPECTROSCOPIES Ph.D. Thesis
Stephen William Gaarenstroom 1977 139 p
Avail: Univ. Microfilms Order No. 77-30079

The use of X ray photoelectron spectroscopy (XPS or ESCA) to characterize compounds, metals, alloys, and metal-oxygen surfaces was explored. Various procedures for interpreting ESCA spectra were devised. The complex surface chemistry of cadmium-oxygen and silver-oxygen were examined and characterized with the aid of sets of reference compounds. The various intial and final state factors which influence ESCA chemical shifts were examined. A theory was developed for predicting Auger energies which employed an atomistic approach and which is rigorous within the framework of the theory of atomic and extra-atomic relaxation. Detailed calculations are given for the L3M23M23 and L3M45M45 Auger energies of Ni, Cu, and Zn. The Auger and binding energy shifts in PdAg and CuNi alloys were also studied. Relaxation energies were calculated.
Dissert. Abstr.

N78-18145 Louisiana State Univ. and A&M Coll., Baton Rouge.
STRUCTURE ELUCIDATION BY NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY Ph.D. Thesis
Gary Paul Juneau 1977 158 p
Avail: Univ. Microfilms Order No. 77-28683

Nuclear magnetic resonance studies, including nuclear Overhauser effects (NOE), long range coupling and lanthanide shift reagent experiments were carried out on several bisbenzylisoquinoline alkaloids from Tiliacora racemosa including tiliacorine, tiliacorinine, N-acetyltiliamosine, and nortiliacorinine-A and their derivatives. The gross structures were determined, showing the position of the hydroxy, methyl, acetoxy and methoxy groups. The structures of nine furan derivatives were determined by the use of coupling constants and nuclear Overhauser effects. A mixture of two sesquiterpene lactones, repandin A and B, was isolated from Tetragonatheca repanda (Compositae). NMR studies, including NOE, long range coupling and lanthanide shift reagent experiments were used for the structure elucidation of the two terpenoids. Dissert. Abstr.

N78-18146 Tennessee Univ., Knoxville.
MATRIX ISOLATION FOURIER TRANSFORM INFRARED SPECTROSCOPY OF POLYCYCLIC AROMATIC HYDROCARBONS Ph.D. Thesis
Richard Bay Kemmerer 1977 142 p
Avail: Univ. Microfilms Order No. 77-27673

Matrix isolated samples were prepared by codeposition of polycyclic aromatic hydrocarbon (PAH) vapors and a large excess of nitrogen at 15 K. PAH's were vaporized and directed to the deposition surface by means of a Knudsen effusion cell. Matrix Isolation Fourier Transform Infrared (MI-FT-IR) absorption spectra for 18 PAH's were obtained. The IR absorption bands between 900-700 per cm for the PAH's studied were sufficiently narrow to resolve several isomers and complex mixtures. Spectral subtraction of PAH mixtures which contained similar spectral features permitted identification of individual components. The PAH content in synthetic liquid fuel (Synthoil and shale oil fractions prepared by high pressure liquid chromatography was partially determined by MI-FT-IR. Beer's law was shown to apply to MI-FT-IR PAH samples over a wide concentration range. Using beam condensing optics, a detection limit of 50 ng of perylene was achieved. Precision was dependent on the sampling arrangement used and varied from 15% to 5%. Dissert. Abstr.

N78-18147 Tennessee Univ., Knoxville.
MATRIX ISOLATION FLUORESCENCE SPECTROSCOPY OF POLYCYCLIC AROMATIC HYDROCARBONS Ph.D. Thesis
Robert Clifton Stroupe 1977 127 p
Avail: Univ. Microfilms Order No. 77-27689

A versatile high-resolution fluorometer was constructed for use with a closed cycle cryogenic refrigerator to allow the performance of quantitative low-temperature fluorometry by the technique of matrix isolation. Matrix isolated samples of polycyclic aromatic hydrocarbons (PAH) are prepared by mixing the vapors of the PAH effusing from a Knudsen oven with a large excess of nitrogen gas and depositing the mixture onto a sapphire window at 15 K. Quantitative working curves for PAH's are typically linear over four to five decades of concentration even in mixtures of isomeric compounds. The use of matrix isolation fluorometry has been applied to the identification and quantitation of several PAH's in complex samples derived from coal liquids (synthoil and shale oil). Dissert. Abstr.

N78-18148 Colorado State Univ., Fort Collins.
APPLICATION OF MINICOMPUTERS TO STUDIES IN ELECTROANALYTICAL CHEMISTRY Ph.D. Thesis
John Augustus Turner 1977 332 p
Avail: Univ. Microfilms Order No. 77-28335

A minicomputer system was used for studies of various waveforms of interest in electroanalytical chemistry. These waveforms include staircase, normal pulse, differential pulse and square wave. Both ordinary and rapid scan techniques were programmed. Comparisons are made of the current-potential characteristics as well as their response near the limit of detection. The application of normal pulse polarography for the analytical determination of substances which form insoluble films on mercury was demonstrated. Various parameters governing normal pulse polarographic currents were investigated. Analytical determination is enhanced by long drop times and short pulse widths. An analytically useful definition of a detection limit for normal pulse polarography was developed and applied to sulfide ion and iodide ion determination. Dissert. Abstr.

N78-18149 Maryland Univ., College Park.
THE PHOTOCHEMISTRY OF AMIDES AND PHTHALIMIDES Ph.D. Thesis
Michael William Bowen 1977 510 p
Avail: Univ. Microfilms Order No. 77-28735

A 2 percent solution of amide in dioxane, when irradiated through quartz with light greater than 200 nm, did not decompose in the Type II fashion to yield N-alkyl acetamides, alkenes, and unsubstituted amides. The dimers of dioxane and cyclohexane, created via hydrogen abstraction, were the main products of amide photodecomposition in these solvents. Tertiary amides reacted faster than secondary amides. Unsymmetrical anilide imides photodecomposed in dioxane to yield a wide variety of products. The Photo-Fries decomposition mode was most favored where acyl groups migrated to positions ortho and para to the amine substituent. N-Alkylphthalimides underwent initial gamma-hydrogen abstraction to yield a 1,4-biradical followed by ring closure to form an azacyclobutanol intermediate. Quantum yield determination as well as mechanistic investigation was conducted. Dissert. Abstr.

N78-18150 Indiana Univ., Bloomington.
STUDIES OF ATOMS VAPORIZED FROM INDIVIDUAL SOLUTE PARTICLES IN ANALYTICAL FLAMES Ph.D. Thesis
Charles Ben Boss 1977 146 p
Avail: Univ. Microfilms Order No. 77-30277

An accurate and convenient new method for the measurement of rise velocity was developed. This new method uses vapor phase atoms to probe the velocity, and therefore avoids errors caused by gravitational attraction. The new technique also allows spatial resolution in the velocity measurements and is easily automated. Also presented is a unified theoretical and experimental attack on the question of atom distribution in analytical flames or plasmas. The fundamental process is the migration of atoms from an individual solute particle, a feature which can be studied. A theoretical model was developed which describes the synergic effects of vaporization and diffusion in determining this migration. The model employs the convolution of the two processes to describe the spatial distribution of atoms about an individual, vaporizing solute particle. Dissert. Abstr.

N78-18151 Ohio Univ., Athens.
INFRARED FOURIER TRANSFORM SPECTROSCOPY OF CHROMATOGRAPHICALLY SEPARATED SPECIES Ph.D. Thesis
Maria Myriam Gomez-Taylor 1977 172 p
Avail: Univ. Microfilms Order No. 77-32230

A system was designed and constructed to increase the sensitivity of the interface between a gas chromatograph and a single beam rapid scanning Fourier transform infrared spectrometer (GC-IR). With this system, an increase in sensitivity was achieved by replacing the nichrome wire source of the standard Digilab FTS-14 Fourier transform spectrometer by a modified Nernst glower source with operates at a higher temperature than the nichrome wire. A long (30 cm) and narrow (4 x 4 mm square) light pope gas cell was used. The transmittance between the interferometer and the detector was about 25% enabling on line spectra to be measured with relatively low noise. Dissert. Abstr.

N78-18152 Brigham Young Univ., Provo, Utah.
REAL-TIME COMPUTER OPTIMIZED SCANNING POTENTIAL COULOMETRY FOR MULTI-COMPONENT TRACE ANALYSIS Ph.D. Thesis
Norman W. Petty 1977 127 p
Avail: Univ. Microfilms Order No. 77-31122

The instrumentation and methodology for real time computer controlled scanning potential coulometry for multi-component trace analysis is described. The sensitivity limit was determined to be 10 to the minus 8th power F for electrochemically reversible constituents. The sensitivity limit could be extended if measures were taken to compensate for the periodic signal found on the electrolysis current. Non-linear least squares curve fitting methods accurately resolved iron platinum and silver iron interferences to give accurate determinations for iron and silver. The resolving capability of this method was tested using theoretically generated scanning potential coulograms. Dissert. Abstr.

N78-18153 Syracuse Univ., N. Y.
AN INVESTIGATION OF METAL VERSUS LIGAND CENTERED REDOX PROCESSES IN SELECTED TRANSITION METAL MACROCYCLIC COMPLEXES. THE APPLICATION OF A MICROCOMPUTER TO VOLTAMMETRY Ph.D. Thesis
Francis Carroll McElroy 1977 231 p
Avail: Univ. Microfilms Order No. 77-30745

Electrochemical and other physical techniques were used to establish the site of the redox process in saddle shaped complexes. The electrochemical redox behavior of macrocycle ligands containing azo linkages and their Ni(2) complexes was similar to that of azobenzene. These compounds exhibit two ligand centered one electron reductions. The Ni(II) complex exhibits electrochemical evidence which suggests that this photochromic complex may also dimerize. When this azo substituent was attached to both methine carbon atoms of the macrocycle, the electrochemical studies of the resulting Ni(2) complex indicate that dimerization does not occur. Dissert. Abstr.

N78-18154 Purdue Univ., Lafayette, Ind.
EFFECTS OF PRESSURE ON ION EXCHANGE AND ION PAIRING CHROMATOGRAPHY Ph.D. Thesis
Gabriel Prukop 1977 125 p
Avail: Univ. Microfilms Order No. 77-30124

The effects of pressure on retention in cation exchange and in reverse phase liquid chromatography are presented. First, the effects of pressure up to 345 MPa on a reverse phase ion pairing system were studied in 50% methanol-water. Retention increased by a factor of 3.2 for methyl orange when the pressure was increased to 241 MPa and still larger at 345 MPa. The retention of methyl red was increased by a factor of 2.2 by a pressure of 241 MPa and by a factor of 2.5 by 345 MPa. When the methanol concentration was increased to 75%, retention increased by a factor of 2.6 between 68.9 MPa and 345 MPa. The effects of pressures up to 360 MPa on the capacity factors of sodium, potassium, rubidium, lithium, and magnesium ions were studied using nitrate eluents. The capacity factors also were changed by almost 25% for rubidium and potassium ions by going from atmospheric pressure to 360 MPa. Dissert. Abstr.

N78-18155 Purdue Univ., Lafayette, Ind.
SIMULTANEOUS KINETIC AND SPECTRAL ANALYSIS USING A VIDICON RAPID-SCANNING STOPPED-FLOW SPECTROMETER Ph.D. Thesis
Gregg M. Ridder 1977 287 p
Avail: Univ. Microfilms Order No. 77-30128

Two methods of multiple component analysis were investigated. Simultaneous kinetic analysis uses a single independent variable, time, and determines the initial concentrations of the reacting species in a mixture based on the differences in their kinetic behavior. A mathematical model for parallel first-order reactions was used to develop a weighted least-squares regression analysis. The analysis calculates the values of the initial concentrations of the individual species which best fits the sum of exponential response curves to the data. The second method of multiple component analysis investigated was the simultaneous kinetic and spectral analysis of mixtures using a computerized stopped-flow vidicon rapid-scanning spectrometer. Dissert. Abstr.

N78-18156 California Inst. of Tech., Pasadena.
THEORETICAL STUDIES OF CHEMISORPTION Ph.D. Thesis
Stephen Perry Walch 1977 313 p
Avail: Univ. Microfilms Order No. 77-22328

Configuration interaction calculations were carried out for a number of positive ion states of NiCO. These calculations indicate that there are two distinct groups of ionization potentials. The first group involves ionizations out of Ni-like orbitals. The second group of ion states correlates at large Ni-C separation with the ground state of the Ni atom and various states of CO+. Electronic wavefunctions were obtained as a function of geometry for an O atom bonded to Ni clusters (consisting of 1 to 5 atoms) designed to model bonding to the Ni(100) and Ni(110) surfaces. Electron correlation effects were included using the generalized valence bond and configuration interaction methods. For the (100) surface, the charge distribution for the full O overlayer is consistent with taking a positively charged cluster.Dissert. Abstr.

N78-18157# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
FOURIER TRANSFORM INFRARED SPECTROSCOPY: DEMONSTRATION OF MEASUREMENT CAPABILITIES IN THE LABORATORY AND THE FIELD
Robert A. Reed Jan. 1978 25 p refs
(RM-648) Avail: NTIS HC A02/MF A01

The measurement capabilities of an infrared interferometer spectrometer are documented for both field and laboratory usage. This instrument provided intermediate resolution coverage in the 1.6 to 5.4 micron spectral interval. It has been used in the field to study radiation from aircraft exhaust plumes, background emission, and atmospheric transmission. In the laboratory, line spectra of flames have been measured and nonequilibrium vibrational temperatures derived. System configuration, operating procedure, and data processing are discussed. The performance of the interferometer is illustrated by typical spectral data.
Author

N78-18158# National Bureau of Standards, Washington, D. C.
STUDIES OF THE FLASH FIRE POTENTIAL OF AIRCRAFT CABIN INTERIOR MATERIALS Final Report, Aug. 1975 - Sep. 1976
Michael J. Manka, Henry Pierce, and Clayton Huggett Dec. 1977 35 p refs Sponsored in part by the National Aviation Facilities Experimental Center (NAFEC), Atlantic City, N.J.
(Contract DOT-FA67NF-AP-21)
(AD-A048475; NA-77-180; FAA-RD-77-47) Avail: NTIS HC A03/MF A01 CSCL 13/12

A minimum energy principle was proposed to characterize the flash fire behavior of the complex mixture of fuels derived from the pyrolysis of organic materials. This principle states that a flash fire is possible when the potential combustion energy content of the pyrolyzate air mixture exceeds approximately 425 cal/L. A variety of experiments was performed to provide support for the minimum energy principle. The results were in general agreement with predictions, but the accuracy of the measurements was not good enough to permit detailed conclusions. Oxidative pyrolysis plays a significant role in the formation of the fuel-air mixture in the flash fire cell. Particulates contribute to the creation of flash fire conditions, but they present a difficult measurement problem. Author

N78-18159# Army Materials Research Agency, Watertown, Mass.
FLAMMABILITY ASSESSMENT TESTS FOR ORGANIC MATERIALS: THE OXYGEN INDEX/TEMPERATURE INDEX CONCEPT Final Report
Domenic P. Macaione and Richard Dowling, II Sep. 1977 20 p
(AD-A047830; AMMRC-TR-77-19) Avail: NTIS HC A02/MF A01 CSCL 11/9

A series of organic polymers, composites, and polymeric foams have been investigated in terms of the Oxygen Index Method (ASTM-2863-74). The change in oxygen index as a function of temperature was determined for each material between ambient and 300 C and data plotted to prepare a temperature index profile. Author (GRA)

N78-18160# Chicago Univ., Ill. James Frank Inst.
GAS SURFACE INTERACTIONS Annual Summary Report, 1 Mar. 1977 - 1 Jan. 1978
Lennard Wharton 5 Jan. 1978 7 p refs
(Contract N00014-77-C-0240)
(AD-A048667) Avail: NTIS HC A02/MF A01 CSCL 07/4

Gas surface interactions have been studied in the first year of operation of a new state-of-the-art apparatus that can study individual gas-surface collisional events or the velocity distributions of recombining species. Systems studied included Tungsten-O2, N2, H2, He, Ar and Platinum-He, O2/CO, O2/C2H2, O2/C2H4. The direct reaction of oxygen with tungsten has been characterized. The indirect molecular precursor reaction of N2 with tungsten is under investigation. The highly non-thermal CO2 produced by oxidation of CO, C2H2 or C2H4 on Pt has been clearly established. Author (GRA)

N78-18161# Aerospace Corp., El Segundo, Calif. Aerothermodynamics Dept.
ANALYTIC SOLUTION FOR THE EQUILIBRIUM COMPOSITION OF A CARBON-NITROGEN-OXYGEN GAS MIXTURE Final Report, Jun. - Aug. 1977
P. G. Crowell 30 Dec. 1977 92 p
(Contract F04701-77-C-0078)
(AD-A048597; SAMSO-TR-77-146; TR-0078(3550-15)-1) Avail: NTIS HC A05/MF A01 CSCL 07/2

An approximate analytic solution has been developed for the equilibrium composition of a gas mixture whose elemental composition consists of carbon-nitrogen-oxygen and an inert species. Neither condensed nor ionized species are considered. Trace species are ignored. The species composition is determined for given elemental mass fractions, temperature, and density or pressure. The error in mixture properties is a maximum of four percent and is generally less than one percent. The computation speed ranges from two-to-three orders of magnitude faster than exact calculation procedures, depending upon the initial guess supplied to the exact calculation. The analytic solution is particularly suited for use in boundary layer calulations over an ablating carbon surface. It should also find use in planetary entry applications and other fluid dynamic problems where the gas of interest contains carbon, nitrogen, and oxygen species.
GRA

N78-18162# Miami Univ., Oxford, Ohio. Dept. of Chemistry.
POLARIZED INFRARED SPECTRAL STUDIES OF CRYSTALLINE, HYDROGEN-BONDED ORGANIC ACIDS Final Report, Jan. 1975 - Apr. 1977
J. E. Katon, P. F. Krause, K. K. Smith, and J. M. Rogers Wright-Patterson AFB, Ohio AFML May 1977 37 p refs
(Contract F33615-73-C-5013)
(AD-A048587; AFML-TR-77-89) Avail: NTIS HC A03/MF A01 CSCL 07/3

Polarized infrared spectra of oriented samples has been shown to be very useful in the study of the structures and properties of crystals. In principle, this method can be used to elucidate crystal structures. It has not been clear how this method can be utilized with hydrogen-bonded materials, however. This is due to the fact that hydrogen bonds are much weaker than chemical bonds. The method in which such substances should be treated (the size of the unit to be chosen as the molecule, whether to treat the hydrogen-bond differently than chemical bonds, etc.) has not been clear. This report gives the results of two studies of polarized crystal infrared spectra of hydrogen-bonded organic acids. Acrylic acid exists as a hydrogen-bonded dimer in the crystal and acetic acid exists as a hydrogen-bonded polymer in the crystal. The results are compared with the X-ray data and the theoretical treatment is carried out considering the hydrogen bonding in detail. It is shown that the correlation method is theoretically satisfactory for these hydrogen-bonded materials provided they crystallize in an orderly fashion. Author (GRA)

N78-18163# Wisconsin Univ., Madison. Dept. of Mechanical Engineering.
EMISSION FORMATION IN HETEROGENEOUS COMBUSTION Progress Report, 10 Nov. 1976 - 9 Feb. 1977
G. L. Borman, P. S. Myers, O. A. Uyehara, L. Evers, and M. Ingham Feb. 1977 163 p refs
(Grant EPA-R-803858-01-1)
(PB-274599/0; EPA-460/3-77-006) Avail: NTIS HC A08/MF A01 CSCL 14B

An investigation of a stratified-charge engine concept in which spark ignited combustion in an engine with a homogeneous rich charge is completed and then air is injected during the expansion stroke giving a leaner overall fuel-air ratio is presented. Nitrogen oxides produced by burning of liquid normal heptane from a fuel wetted porous cylinder in a cross flow of air were examined. The part load operation of the Newhall divided chamber engine was studied. An emissions and fuel economy evaluation of the engine relative to other engines was also given. GRA

N78-18164# Sandia Labs., Albuquerque, N. Mex. Advanced Mechanical Div.
ANALYTICAL MODEL OF A SINGLE AXIS ATTITUDE ROLL CONTROL SYSTEM
M. H. Rogers Jun. 1977 81 p refs
(Contract EY-76-C-04-0789)
(SAND-77-8256) Avail: NTIS HC A05/MF A01

The B77 weapon system currently under development uses a reaction system to control the roll attitude of the vehicle during flight. The development of a mathematical model used to predict the performance of this roll control system is described. In addition, the implementation of this model on a digital computer is discussed along with a comparison of predicted system performance versus observed performance. ERA

N78-18165# National Physical Lab., Teddington (England). Div. of Chemical Standards.
METHODS FOR THE CALCULATION OF THE VALUE OF THE LOGARITHM OF THE ACTIVITY COEFFICIENT OF A COMPONENT AT INFINITE DILUTION FROM BINARY VAPOUR-LIQUID DATA
E. F. G. Herington Jul. 1977 35 p refs
(NPL-Chem-74) Avail: NTIS HC A03/MF A01

Six mathematical methods for the determination of the logarithm of the activity coefficient of a component at infinite dilution from measurements on binary solutions of the compositions of vapors and liquids in equilibrium are discussed. A scheme for the treatment of experimental data to obtain a value of the required logarithm is proposed. Examples of the mixtures ethanol/water, 4-methylpyridine/water and ethanol/water isothermal data at 298.15 K are given. A versatile three constant equation for representing changes of activity coefficient with composition in some binary mixtures is annexed. ESA

N78-18166# National Physical Lab., Teddington (England). Div. of Chemical Standards.
THE pVT PROPERTIES OF ACETIC ACID
I. J. Lawrenson, D. A. Lee, and G. B. Lewis Oct. 1977 20 p refs
(NPL-Chem-76) Avail: NTIS HC A02/MF A01

The pVT properties of acetic acid in the saturated and single-phase regions were measured at temperatures between 448.15 and 603.15 K, at pressures up to about 10 MPa. The experimental results were corrected for decomposition of the sample. Author (ESA)

N78-18167# Lyon Univ. (France). Inst. de Physique Nucleaire.
SILICON OXIDATION STUDIED BY ELECTRON SPECTROSCOPY [L'OXIDATION DU SILICIUM SUIVIE PAR SPECTROSCOPIE D'ELECTRONS]
G. Hollinger and Minh Duc Tran Mar. 1977 10 p refs In FRENCH; ENGLISH summary Presented at the 3d Intern. Colloq. 'Phys. et Chimie des Surfaces', Grenoble, France, 1-3 Jun. 1977
(LYCEN-7719) Avail: NTIS HC A02/MF A01

Interaction of oxygen with a clean silicon (111) surface at room temperature and in the 700 to 1000 C temperature range was studied by electron spectroscopy. Grown oxide films were investigated by combining various excitation sources: AL K alpha, Mg K alpha, Zr M zeta, Cr K alpha, and He II. Silicon dioxide was shown to appear during the first stage of oxidation but bulk properties are reached for films about 25 thick. The thickness of the intermediary oxide transition larger at the silicon to silicon dioxide interface varies with oxidation temperature and is of order 5 A at about 800 C. ESA

N78-18168*# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
THE THERMODYNAMIC PROPERTIES OF SLUSH HYDROGEN AND OXYGEN Final Report
Hans M. Roder Nov. 1977 44 p refs Sponsored in part by NASA
(NASA-CR-155743; PB-274186/6; NBSIR-77-859) Avail: NTIS HC A03/MF A01 CSCL 07D

The thermodynamic properties of hydrogen and oxygen have been calculated for temperatures both below and above the triple point. Values of the various physical properties required for the computations are either taken fron the literature, or are extrapolated. If extrapolated, the extrapolations are based on the known behavior of other simple fluids. The results are presented in the form of computer programs which cover two regions of the phase diagram, solid-vapor, and solid-liquid. Input to the programs is temperature and quality. The properties returned include pressure, density, enthalpy, entropy and internal energy. GRA

N78-18169# National Bureau of Standards, Washington, D. C.
NATIONAL BUREAU OF STANDARDS JOURNAL OF RESEARCH, SECTION A: PHYSICS AND CHEMISTRY, VOLUME 81A, NUMBERS 2 AND 3, MARCH - JUNE 1977 Bimonthly Report
Jun. 1977 100 p refs
(PB-275037/0; TNBAAS-81A(2/3); LC-62-37059) Avail: NTIS HC A05/MF A01 CSCL 07D

A broad range of physical and chemical research was presented with major emphasis on standards of physical measurement, fundamental constants, and properties of matter. Papers presented include the following: (1) Diffusion with discontinuous swelling. III. Type II diffusion as a particular solution of the conventional diffusion equation; (2) Thermophysical measurements on 90Ti-6Al-4V alloy above 1450 K using a transient (subsecond) technique; (3) Evaporation of liquid droplet; (4) Isotope effects in the association reactions of methyl and ethyl iodide cations; (5) Solubility of Ca5(PO4)3OH in the system Ca(OH2-H3PO4H2O) at 5, 15, 25, and 37 C; and (6) Thermodynamics of the densification process for polymer glasses. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N78-18170 Yale Univ., New Haven, Conn.
STRUCTURE AND INTRAMOLECULAR INTERCONVERSIONS OF SOME ORGANOMETALLIC COMPLEXES Ph.D. Thesis
Mark Andrew Adams 1977 168 p
Avail: Univ. Microfilms Order No. 77-27799

The series of compounds (Cu eta-allyl)Fe(CO sub 3 X(X=halogen) exist in solution as two conformers which differ in their orientation of the allyl moiety. The major isomers for each compound in the series X=I, Br, Cl, NCO are shown to possess the same configuration and the use of lanthanide relaxation and shift reagents for the isocyanate complex shows this configuration to be the one in which the central allyl proton points away from the X group. The barrier and mechanism of isomer interconversion was investigated using spin saturation transfer techniques. The isomers of the iodide complex were shown to interconvert by rotation of the allyl with a free energy barrier out of the major isomer of 17.4 kcal/mole. The practicality of using paramagnetic relaxation in C-13 nuclear magnetic resonance for structural studies was shown using Gd(dpm) sub 3. Dissert. Abstr.

N78-18171 Princeton Univ., N. J.
TRANSITION METAL-ASSISTED OXIDATION OF ORGANIC COMPOUNDS Ph.D. Thesis
Thomas Frederick Blackburn 1977 182 p
Avail: Univ. Microfilms Order No. 77-28110

Oxidation of organozirconium compounds, homogeneous catalytic oxidation of alcohols, and possible epoxidation systems for selective olefin oxidation were examined. Oxygen at atmospheric pressure reacts with alkylzirconium compounds to give alkoxyzirconium compounds before hydrolysis, and free alcohol after hydrolysis. The mechanism of the reaction with oxygen was investigated. Stoichiometric and stereochemical results and control reactions indicate that a free radical pathway was followed, and results from an added radical inhibitor further suggest that there were two distinct mechanisms, one a radical chain process and the other a solvent cage recombination process. One of the goals of this thesis was the development of a homogeneous catalytic system to selectively oxidize alcohols to carbonyl compounds under mild conditions in high yields with atmospheric pressure oxygen. Dissert. Abstr.

N78-18172 Texas Univ., Austin.
THE SYNTHESIS AND STUDY OF SOME NOVEL ORGANO-TRANSITION METAL COMPOUNDS Ph.D. Thesis
Charles Edward Capshew 1977 177 p

Avail: Univ. Microfilms Order No. 77-29002

Products from the chemical reactions of Mo2H(CO)X anions with various compounds are reported. Other synthesis is investigated. Yield percentages for some chemical products are reported.

G. Y.

N78-18173 Texas Univ., Austin.
STUDIES OF CARBON MONOXIDE AND OXYGEN CHEMISORBED ON PALLADIUM AND RELATED METALS Ph.D. Thesis
Bor-Her Chen 1977 156 p
Avail: Univ. Microfilms Order No. 77-29005

The photoenhancement of the oxidation of carbon monoxide over palladium was studied at low and high pressures on the temperature range 300 to 443 K. At a total pressure of 20 torr there is a marked photoenhancement of the rate while at pressures below 0.0001 torr no enhancement was detectable. A correlation of these data and infrared spectroscopic data is established which suggests that a weakly bound state of CO is intimately involved in the photoenhancement process. The temperature dependence of the photoeffect is discussed and possible mechanisms are presented. The electronic structure of small clusters modeling the adsorption of carbon monoxide on nickel and palladium and the adsorption of oxygen on palladium and platinum were calculated theoretically. Dissert. Abstr.

N78-18174 Carnegie-Mellon Univ., Pittsburgh, Pa.
THE EFFECT OF MICROSTRUCTURE AND STRENGTH ON THE FRACTURE TOUGHNESS OF AN 18 Ni, 300 GRADE MARAGING STEEL Ph.D. Thesis
Joseph Adam Psioda 1977 328 p
Avail: Univ. Microfilms Order No. 77-27725

Fractography and metallographic sectioning were used to investigate the influence of microstructure and strength on the fracture toughness and fracture mechanism of an 18 weight percent Ni, 300 grade maraging steel. The 300 grade maraging steel is a precipitation hardenable system used as a vehicle material by which to understand why there exists an inverse relationship between strength and toughness which is frequently observed in high strength aluminum, titanium, and steels. The single heat of maraging steel contains three size distributions of inclusions that serve as sites for void formation. These size distributions are made up of Ti(C,N), Ti2S, and TiC inclusions. The Ti(C,N) and Ti2S inclusions fail by a combination of particle cracking and particle-matrix interface decohesion suggesting a critical stress plus plastic strain or energy criterion.

Dissert. Abstr.

N78-18175 Carnegie-Mellon Univ., Pittsburgh, Pa.
THE ROLE OF TRAPPING ON HYDROGEN TRANSPORT AND EMBRITTLEMENT Ph.D. Thesis
Gerard Michel Pressouyre 1977 332 p
Avail: Univ. Microfilms Order No. 77-27724

Alloys of Fe-Ti in both the carburized and uncarburized condition were chosen as the model material to simulate internal trapping of hydrogen. Microstructure characterization revealed that all alloys consisted of a ferrite matrix in which free substitutional titanium atoms and titanium carbide particles were present. Techniques were developed to distinguish between reversible traps. A classification of the traps in terms of strength, density, occupancy and reversible character, was then obtained. Based upon the results of trap characterization, hydrogen embrittlement of Fe-Ti alloys was then examined. The kinetics and extent of static hydrogen embrittlement was both theoretically modelled and experimentally investigated. The best alloys were those with a fine distribution of irreversible TiC particles. A qualitative model was proposed to explain the reasons for this. Lastly, sets of criteria were proposed for the design of alloys that would resist both static and dynamic hydrogen embrittlement. Dissert. Abstr.

N78-18176 Carnegie-Mellon Univ., Pittsburgh, Pa.
MECHANISM OF CLEAVAGE FRACTURE IN PEARLITIC EUTECTOID STEEL Ph.D. Thesis
Yong-Jin Park 1977 154 p
Avail: Univ. Microfilms Order No. 77-28821

The process of cleavage fracture in pearlitic eutectoid steel has been investigated using unnotched tensile specimens and precracked Charpy impact specimens. The cleavage fracture process has been conveniently divided into two stages, i.e., initiation and propagation, and the two stages have been studied separately. Nonpropagating microcracks near the fracture surfaces and the initiation sites on the fracture surfaces were examined by both scanning and transmission electron microscopy. The critical crack size was calculated by a fracture mechanics analysis. The process of crack propagation was studied using scanning electron microscopy by simultaneous viewing of fracture topography and microstructure. Dissert. Abstr.

N78-18177 Iowa State Univ. of Science and Technology, Ames.
ELECTROMIGRATION OF HYDROGEN AND DEUTERIUM IN VANADIUM, NIOBIUM AND TANTALUM Ph.D. Thesis
Craig Leebens Jensen 1977 132 p
Avail: Univ. Microfilms Order No. 77-29844

The electric mobility and effective valence of hydrogen and deuterium in vanadium, niobium, tatalum and three niobium-tantalum alloys were measured. The effective valence for hydrogen isotopes was found to be positive for the pure metals and alloys with the possible exception of tantalum at solute concentrations below 1.5 atomic percent. The isotope effect for the effective valence was generally small in contrast to the isotope effect in the electric mobility which exceeded the classically expected value. Electrical resistivity of the alloys obeyed the parabolic Nordheim relation for a binary alloy. The specific resistivity of hydrogen isotopes was found to be a linear function of alloy composition with the resistivity associated with hydrogen being greater than that for deuterium where an isotope effect was observed. Dissert. Abstr.

N78-18178 Virginia Univ., Charlottesville.
AMALGAM STABILIZATION BY SELECTIVE INTERFACIAL AMALGAMATION Ph.D. Thesis
Lyle Dean Zardiackas 1977 128 p
Avail: Univ. Microfilms Order No. 77-28581

A composite linear material formed at the tooth-amalgam interface provides corrosion resistance and improved bonding in dental restoration of human molars. Samples were prepared in bovine teeth to compare the mechanical shear strength of unlined controls with samples prepared with composite liners formed using a modified polyacrylate cement as the matrix and either silver flake or less than 1 micron silver spheres as the composite filler. The integrity of the liner as well as elemental composition of the liner were examined using scanning electron microscopy and dispersive X-ray energy analysis. Corrosion tests were conducted by differential aeration in 1.0 w/o NaCl at 37 C with lined samples being compared to unlined controls.

Dissert. Abstr.

N78-18179 Cornell Univ., Ithaca, N. Y.
HIGH PRESSURE HOT PRESSING OF TANTALUM CARBIDE TO ATTAIN A TWO HUNDRED ANGSTROM GRAIN SIZE Ph.D. Thesis
Warren Craig Yohe 1977 164 p
Avail: Univ. Microfilms Order No. 77-28392

Tantalum carbide with an average submicron grain size of 200 A with no grains larger than 2000 A was produced by high pressure hot pressing of ultrafine powder, for the purpose of improving mechanical properties. The starting powder was refined by centrifuging to narrow the particle size distribution. Vacuum encapsulated samples were densified for five minutes at temperatures ranging from 800 C to 1700 C and at pressures of 1.5, 3.0 and 4.5 GPa in a girdle type pressure vessel. The minimum grain size of 200 A was attained for samples of maximum density at 1200 C and 3.0 GPa. Increasing the pressure was found to inhibit grain growth at higher temperatures. Knoop hardness of the samples increased with increasing density and decreasing grain size. Dissert. Abstr.

N78-18180 Virginia Univ., Charlottesville.
COMPUTER MODEL FOR VACANCY-SURFACE INTERACTIONS IN bcc METALS Ph.D. Thesis
Patrick James White 1977 126 p
Avail: Univ. Microfilms Order No. 77-28598

The crystal energy is written as the sum of contributions from a two body semi-empirical potential energy function extending through second-neighbor interactions and from a volume dependent term. The calculational model includes a self consistent formulation for the treatment of the volume dependent term at

surfaces. A number of calculations were performed to determine vacancy formation and migration energies as a function of distance from the crystal surface and as a function of the surface orientation. Results indicate that within about 4 to 4.5A of a surface vacuum interface vacancy migration toward the surface becomes energetically very favorable. Dissert. Abstr.

N78-18181 Virginia Univ., Charlottesville.
DUCTILE FRACTURE INITIATION IN PURE ALPHA-FE Ph.D. Thesis
Richard Neal Gardner 1977 160 p
Avail: Univ. Microfilms Order No. 77-28634

Alpha Fe crystals of various orientations and geometries were grown by the hydrogen reduction of ferrous chloride. Whiskers in the form of filaments were procured by a controlled growth technique. All whiskers were found to be of a high degree of overall crystalline perfection. The application of the precession method enabled the characterization of their active deformation modes. As a result of fracture experiments in the high voltage electron microscope, it was concluded that the initiation of microcracks occurred at cell boundaries. The existence of cells as well as cell rotations continued up to the ultimate tensile stress of these whiskers. These experiments have enhanced the understanding of the nature of dislocation microstructure in stage 3 workhardening, and have elucidated the mechanism of crack nucleation in high purity ductile specimens. Dissert. Abstr.

N78-18182* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TANTALUM MODIFIED FERRITIC IRON BASE ALLOYS Patent
Robert E. Oldrieve and Charles P. Blankenship, inventors (to NASA) Issued 25 Oct. 1977 3 p Filed 21 Jan. 1976 Supersedes N76-17233 (14 - 08, p 0958)
(NASA-Case-LEW-12095-1; US-Patent-4,055,416; US-Patent-Appl-SN-651009; US-Patent-Class-75-124; US-Patent-Class-75-126D; US-Patent-Class-75-126F; US-Patent-Class-75-128G; Us-Patent-Class-75-128T) Avail: US Patent Office CSCL 11F

Strong ferritic alloys of the Fe-CR-Al type containing 0.4% to 2% tantalum were developed. These alloys have improved fabricability without sacrificing high temperature strength and oxidation resistance in the 800 C (1475 F) to 1040 C (1900 F) range. Official Gazette of the U.S. Patent Office

N78-18183* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DIRECTIONALLY SOLIDIFIED EUTECTIC GAMMA-GAMMA NICKEL-BASE SUPERALLOYS Patent
Melvin R. Jackson, inventor (to NASA) Issued 25 Oct. 1977 7 p Filed 7 May 1976
(NASA-Case-LEW-12905-1; US-Patent-4,055,447; US-Patent-Appl-SN-684171; US-Patent-Class-148-32; US-Patent-Class-75-170; US-Patent-Class-148-32.5) Avail: US Patent Office CSCL 11F

A directionally solidified multivariant eutectic gamma-gamma prime nickel-base superalloy casting having improved high temperature properties was developed. The alloy is comprised of a two phase eutectic structure consisting essentially of, on a weight percent basis, 6.0 - 9.0 aluminum, 5.0 - 17.0 tantalum, 0-10 cobalt, 0-6 vanadium, 0-6 rhenium, 2.0-6.0 tungsten, and the balance being nickel, subject to the proviso that the sum of the atomic percentages of aluminum plus tantalum is within the range of from 19-22, and the ratio of atomic percentages of tantalum to aluminum plus tantalum is within the range of from 0.12 - 0.23. Embedded within the gamma nickel-base matrix are aligned eutectic gamma prime phase (primarily nickel-aluminum-tantalum) reinforcing fibers.
Official Gazette of the U.S. Patent Office

N78-18184 Ohio State Univ., Columbus.
THEORY OF THE GALVANOMAGNETIC PROPERTIES OF INHOMOGENEOUS METALS: APPLICATION TO COPPER Ph.D. Thesis
Fuh-Perng Pan 1977 95 p
Avail: Univ. Microfilms Order No. 77-31949

The effective medium approximation was applied to compute the effective conductivity tensor of metals with anisotropic inhomogeneities of various shapes. In the case of a free electron metal containing isolated defects, such as voids, open orbits, or extended orbits, the transverse magnetoresistivity has a strictly linear relationship with H in configurations having a spherical defect, or a cylindrical defect with its axis perpendicular to H, however, it saturates in configuration having a cylindrical defect with its axis parallel to H. But allowing for interactions between defects, leads to a saturating transverse magnetoresistivity in all three configurations. In a more realistic model appropriate to polycrystalline copper, the dominant role played by extended orbits, is demonstrated. Dissert. Abstr.

N78-18185# Illinois Univ., Urbana-Champaign. Dept. of Metallurgy and Mining Engineering.
ON THE OXIDATION OF NIOBIUM IN PURE HYDROGEN ATMOSPHERES
B. J. Makenas 18 Oct. 1977 13 p refs
(Contract N00014-75-C-1012)
(AD-A047963) Avail: NTIS HC A02/MF A01 CSCL 11/6

The oxidation of niobium at very low partial pressures of oxygen was studied using transmission electron microscopy and electron diffraction. The oxidation was carried out in 'high purity' hydrogen atmospheres. Author (GRA)

N78-18186# Naval Postgraduate School, Monterey, Calif.
A STUDY OF THE EFFECT OF VELOCITY ON CORROSION OF GALVANIC COUPLES IN SEAWATER USING A CIRCLING-FOIL APPARATUS Technical Report, Mar. - Nov. 1977
Jeff Perkins, Kenneth J. Graham, Gary A. Storm, John S. Locke, and J. R. Cummings Dec. 1977 36 p refs
(AD-A048065; NPS-69PS77004; TR-4) Avail: NTIS HC A03/MF A01 CSCL 11/6

A unique apparatus has been developed to study velocity effects on corrosion processes, and has been used initially to expose single metals and galvanic couples of some common marine structural materials in synthetic seawater electrolyte, under controlled hydrodynamic conditions at various relative velocities. The sample-holder in the apparatus has a standard foil profile, with a turbulence trip wire at the leading edge. Direct determinations of turbulence intensity, boundary layer thickness, and surface shear stress were made at various velocities, enabling correlations of hydrodynamic models with electrochemical data and other observations of corrosion behavior. The effects of velocity and potential distribution on average corrosion rates, and on the mode and distribution of corrosive attack and corrosion products, have been studied. Author (GRA)

N78-18187# Illinois Univ., Urbana-Champaign. Dept. of Metallurgy and Mining Engineering.
HYDROGEN EMBRITTLEMENT OF NIOBIUM 3: HIGH TEMPERATURE BEHAVIOR
S. Gahr and H. K. Birnbaum 18 Oct. 1977 32 p refs
(Contract N00014-75-C-1012)
(AD-A047957) Avail: NTIS HC A03/MF A01 CSCL 11/6

The deformation behavior of niobium hydrogen alloys was investigated in the temperature range 125-500 C and at compositions up to H/Nb of 0.9. High temperature tensile tests and fractographic studies were applied to determine the fracture mechanisms. It was shown that at T approximately less than 450 C and H/Nb approximately greater than 0.3 fracture occurs by a cleavage mode. The mechanism of the high temperature hydrogen embrittlement was discussed. The fracture mechanism is shown to be consistent with the stress induced formation and cleavage of NbH2. Author

N78-18188# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
ACCELERATED LABORATORY CORROSION TEST FOR MATERIALS AND FINISHES USED IN NAVAL AIRCRAFT Progress Report
S. J. Ketcham 14 Sep. 1977 12 p refs
(AD-A048059; NADC-77252-30) Avail: NTIS HC A02/MF A01 CSCL 14/2

An accelerated laboratory corrosion test has been developed to screen materials and finishes for use on naval aircraft. Sulfur dioxide is introduced at periodic intervals into a conventional salt fog chamber to simulate conditions produced by the carrier

stack gas/marine environment. Procedures for conducting the test are described. Author (GRA)

N78-18189# Illinois Univ., Urbana-Champaign.
RESEARCH ON MARTENSITIC TRANSFORMATIONS IN IRON ALLOYS Final Report, 1 Mar. 1974 - 20 Aug. 1977
C. M. Wayman 7 Nov. 1977 8 p refs
(Grant DAHC04-74-G-0134)
(AD-A047940; ARO-11948.4-MS) Avail: NTIS HC A02/MF A01 CSCL 11/6

Ordering of nearly stoichiometric Fe-25 at.% Pt alloys causes a progressive change in the martensitic transformation from a nonthermoelastic to a thermoelastic type. Accompanying this are several pronounced property changes such as the development of martensite tetragonality and the shape memory effect, reduction of transformation hysteresis, morphology changes and a different mode of reverse transformation, a reduction in the martensite shape strain and driving force at the martensite start temperature, and the onset of invar behavior. These various effects are interrelated. In order to obtain a thermoelastic transformation in Fe-Pt alloys, the martensite start temperature must be lower than a certain value. GRA

N78-18190# Naval Postgraduate School, Monterey, Calif.
INVESTIGATION INTO THE EFFECT OF DISSIMILAR METAL COUPLING, POTENTIAL, AND PROCESSING ON THE MODE AND DISTRIBUTION OF GALVANIC CORROSION ATTACK ON 5086 ALUMINUM ALLOY IN SYNTHETIC SEAWATER M.S. Thesis
John Sinclair Locke Sep. 1977 128 p refs
(AD-A048527) Avail: NTIS HC A07/MF A01 CSCL 11/6

The galvanic corrosion behavior of 5086 aluminum alloy in three tempers (H116, H117, H32) when coupled with three more noble metals (1040 steel, 60/40 naval brass, Ti-150A titanium) and immersed in aerated synthetic seawater has been characterized. In so doing, use was made of potentio-dynamic polarization techniques, galvanic current density monitoring for twenty-four hours, and optical and scanning electron microscopic observations. The results obtained through the use of these techniques are presented and discussed. Galvanic corrosion of 5086 Al when coupled to the dissimilar metals was found to be independent of temper and to decrease in the order (of coupled metals) Ti-150A greater than 60/40 naval brass greater than 1040 steel. The effect of dissimilar metal coupling was found to be reduced by the formation on the anode and cathode of insulating corrosion product structures; this also caused an increased domination of the attack by localized corrosion modes. The effect of edges and crevices in concentrating attack and the correlation between distribution of corrosion product and metal dissolution is discussed. Author (GRA)

N78-18191# Naval Postgraduate School, Monterey, Calif.
THE EFFECTS OF VELOCITY ON CORROSION OF GALVANIC COUPLES IN SEAWATER M.S. Thesis
Gary Alan Storm Sep. 1977 140 p refs
(AD-A048669) Avail: NTIS HC A07/MF A01 CSCL 13/10

The effects of velocity on the corrosion of galvanic couples (70/30 Cu-Ni/plain carbon steel and K-Monel/plain carbon steel) in synthetic seawater electrolyte were studied. A unique experimental apparatus was designed and built, employing a foil-shaped specimen holder rotating in a tank, and the hydrodynamic flow conditions within the test system were carefully characterized. Galvanic current measurements were taken at various velocities and corrosion product formation and dissolution patterns were studied. A model is developed which considers both hydrodynamic and electrochemical boundary layer effects, and the role of the polarization characteristics of the individual metals is discussed. The development of corrosion products, protective oxide films, and surface metal removal are discussed. A corrosion product growth/removal cycle and consequent surface metal removal sequence is hypothesized under dynamic conditions. Author (GRA)

N78-18192# Naval Surface Weapons Center, Dahlgren, Va.
HIGH STRENGTH ALUMINUM CASTING TECHNOLOGY: SQUEEZE CASTING OF 7075 ALLOY Final Report
John R. Thompson, Jr. Oct. 1977 92 p refs
(AD-A048657; NSWC/DL-TR-3744) Avail: NTIS HC A05/MF A01 CSCL 11/6

The objective of this investigation was to develop wrought 7075-T6 mechanical properties in a cast aluminum alloy component of net or near-net shape. A squeeze casting process was selected as the manufacturing process. Following a limited heat treatment optimization effort, mechanical properties of the squeeze cast 7075 alloy components were determined. Sidewall fracture toughness and transverse tensile properties in the closed base of the cylindrical components approached reported properties for wrought 7075-T6 material. Chemical segregation, excessive grain size, low casting soundness and incomplete heat treatment response are thought to be the causes for the reduced mechanical properties. Methods to overcome these shortcomings are identified and a recommendation is made to continue the efforts required to attain the original objective. GRA

N78-18193# Cambridge Univ. (England). Dept. of Metallurgy and Materials Science.
SEGREGATION EFFECTS AND THE TOUGHNESS OF HIGH-STRENGTH STEELS Final Technical Report, 1 Oct. 1973 - 30 Sep. 1976
J. D. Clayton and J. F. Knott Jun. 1977 199 p refs
(Contract DAJA37-74-C-1309; DA Proj. 1T1-61102-B-32D)
(AD-A048448) Avail: NTIS HC A09/MF A01 CSCL 11/6

A study has been made of impurity segregation in low alloy steels and iron alloys. Various problems of practical importance have been investigated together with some of the more fundamental aspects of segregation. The general approach has been to employ simplified alloy compositions and to combine mechanical testing with Auger electron spectroscopy (AES) and scanning electron microscopy. Segregation occurring during the austenitizing cycle has been examined in commercial and high-purity Ni-Cr steels. Low concentrations of P, Sb and Sn do not appear to embrittle as-quenched commercial Ni-Cr or Ni-Cr-Mo steels. By employing higher P concentrations it is shown that P segregation occurs at low austenitizing temperatures in Mn-free Ni-Cr steels. The main effect of Mn additions is to decrease the observed temperature dependence of P segregation in austenite. GRA

N78-18194# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Metallurgy and Materials Science.
THE INFLUENCE OF THERMOMECHANICAL PROCESSING ON THE MICROSTRUCTURE OF METASTABLE BETA-Ti ALLOYS
J. C. Williams, F. H. Froes (Colt Industries, Inc., Pittsburgh, Pa.), C. F. Yolton (Colt Industries, Inc., Pittsburgh, Pa.), and I. M. Bernstein Nov. 1976 11 p refs
(Contract N00014-76-C-0409)
(AD-A048771; JWTR-1) Avail: NTIS HC A02/MF A01 CSCL 11/6

This paper describes the effect of working history on the subsequent microstructure and hardness variations during aging of Ti-11.5Mo-6Zr-4.5Sn. Two different thermomechanical processing schemes were used to vary the percent recrystallization and dislocation density of the metastable bcc phase. These samples were then aged at different temperatures for varying times and the increases in hardness were monitored using Vicker's hardness measurements. Significant differences in hardening response were observed depending on whether the working of the material was completed well below or at the beta-transus. Transmission electron microscopy was used to correlate the age hardening response with microstructure. Significant differences in primary alpha distribution were detected in the as-hot-worked materials processed by the two different schemes and these differences helped to account for the variations in age hardening response. In both materials, it was shown that sufficient heterogeneous nucleation sites in the form of dislocations were present to promote direct nucleation of alpha-phase, thereby eliminating the embrittling omega-phase. Author (GRA)

N78-18195# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Metallurgy and Materials Science.
SOME OBSERVATIONS ON THE STRUCTURE OF Ti-11.5Mo-6Zr-4.5Sn (BETA 3) AS AFFECTED BY PROCESSING HISTORY
J. C. Williams, F. H. Froes (Colt Industries, Inc., Pittsburgh, Pa.), and C. F. Yolton (Colt Industries, Inc., Pittsburgh, Pa.) Mar.

1977 16 p refs
(Contract N00014-76-C-0409)
(AD-A048772; TWTR-2) Avail: NTIS HC A02/MF A01 CSCL 11/6

This paper describes the effect of processing history on properties of the metastable beta titanium alloy Ti-11.5Mo-6Zr-4.5Sn. It is shown that numerous earlier published accounts of properties have corresponded to non-optimum processing. In addition, attempts to correlate microstructure with properties have often been based on questionable microstructural interpretation; this paper also attempts to correct several of these points. Finally, the paper describes what is considered to be closer to if not optimum processing of this alloy.
Author (GRA)

N78-18196# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Metallurgy and Materials Science.
THE RELATIONSHIP BETWEEN THE MICROSTRUCTURE AND AGE HARDENING RESPONSE IN THE METASTABLE BETA TITANIUM ALLOY Ti-11.5Mo6Zr-4.5Sn (BETA 3)
F. H. Froes (Colt Industries, Inc., Pittsburgh), L. F. Yolton (Colt Industries, Inc., Pittsburgh), M. G. H. Wells (Colt Industries, Inc., Pittsburgh), J. C. Williams, and J. M. Capenos (Colt Industries, Inc., Pittsburgh) Aug. 1977 31 p refs
(Contract N00014-76-C-0409)
(AD-A048773; JWTR-3) Avail: NTIS HC A03/MF A01 CSCL 11/6

The effect of solution treatment temperature and oxygen content on the microstructure and age hardening response of the metastable beta alloy Ti-11.5Mo-6Zr-4.5Sn have been studied. Kinetics of formation of the equilibrium alpha-phase and the metastable omega-phase have been followed using Vicker's hardness measurements. These kinetics have been examined as a function of solution treatment temperature (above or below the beta-transus) and initial oxygen of the material. It has been found that the kinetics of formation of omega-phase are relatively insensitive to these variables whereas alpha-phase is quite sensitive. The effect of these variables on microstructure has been evaluated using light microscopy, replica electron microscopy and thin foil transmission electron microscopy. Several duplex aging treatments starting in the omega-phase temperature range and finishing in the alpha-phase temperature range were also examined. TEM of these samples has provided some inside into the mechanism of the omega-approach alpha in-situ transformation.
Author (GRA)

N78-18197# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
ANALOGIES AMONG ACTIVE SITES OF COORDINATIVELY-UNSATURATED TRANSITION-METAL COMPLEXES, SURFACES AND SUPPORTED CATALYSTS Interim Report
K. H. Johnson, A. C. Balazs, and H. J. Kolari 30 Dec. 1977 13 p refs
(Contract N00014-75-C-0970; Grant NSF DMR-74-15224)
(AD-A048289; TR-6) Avail: NTIS HC A02/MF A01 CSCL 07/2

It has been shown by Ugo et al. that the coordinatively-unsaturated transition-metal complex (PPh3)2Pt (bistriphenylphosphine-platinum(0))- exhibits a chemical reactivity and binding stability with respect to the molecules O2, CO, SO2, C2H2, C2H4, H2, and N2 which can be compared on a one-to-one basis with those of a chemisorption site on a platinum surface.
GRA

N78-18198# Cabot Corp., Kokomo, Ind. Satellite Div.
INVESTIGATION OF PROCESSING MICROSTRUCTURES AND PROPERTIES OF OXIDE DISPERSION STRENGTHENED COBALT ALLOY EXTRUDED SHAPES Final Technical Report, 1 Sep. 1974 - 31 Dec. 1976
R. Grierson Apr. 1977 54 p refs
(Contract F33615-75-C-5061)
(AD-A048593; AFML-TR-77-27) Avail: NTIS HC A04/MF A01 CSCL 11/6

The present study describes the development of an Oxide Dispersion Strengthened, Cobalt base alloy with the nominal composition of Co-20Ni-18Cr-4.5A1-1.75 Y2O3. The alloy was produced in extruded form from mechanically attrited powder. In the first part of this study a series of small scale (3 in. dia.) extrusions were produced in order to evaluate various compositional and processing parameters. Based upon this study a single powder composition and three sets of extrusion parameters were chosen for use with full scale 7 in. diameter extrusion billets. Dynamic (Mach 0.3), 2100 F oxidation tests showed the material to have excellent surface stability under these conditions, and hot corrosion testing at 1650 F showed it to be slightly superior to the analogous Ni base O.D.S. materials in this latter type of environment.
GRA

N78-18199# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapons Systems Lab.
CHARACTERIZATION OF CHROMIC-ACID ANODIZED 2024-T3 ALUMINUM ADHERENDS
William J. Russell and Carolyn A. L. Westerdahl Sep. 1977 41 p refs
(AD-A048756; AD-E400010; ARLCD-TR-77040) Avail: NTIS HC A03/MF A01 CSCL 11/1

The topography of 2024-T3 aluminum-alloy surfaces has been characterized by using high-magnification transmission electron microscopy (TEM) at various stages during the chromic-acid anoidizing procedure used to prepare aluminum surfaces for adhesive bonding. The surface structure characteristic of the unsealed chromic-acid anodized alloy was found to form during the first 6 minutes of the 37-1/2-minute anodizing cycle; the surface structure characteristic of the sealed anodized alloy was found to form during the last half of the 8-minute sealing cycle. The surface structure of FPL deoxidized and of unsealed anodized surfaces consists of a repeating pattern of close-packed depressions 200 to 800 angstrom units in diameter. The structure of the sealed surface consists of crevices 500 to 2,000 angstrom units wide between mounds of material formed during sealing. The chemical composition of the surfaces was determined after anodizing and also after sealing the surface, using electron spectroscopy for chemical analysis and auger electron spectroscopy. These surfaces were found to consist of aluminum, oxygen, carbon, and nitrogen with traces of silicon and maganese. Copper and magnesium, two of the major alloying elements in the alloy used, were not detected.
Author (GRA)

N78-18200# California Univ., Livermore. Lawrence Livermore Lab.
THERMOPHYSICAL MEASUREMENTS ON LIQUID METALS ABOVE 4000 K
J. W. Shaner, G. R. Gathers, and W. M. Hodgson 14 Apr. 1977 11 p refs Presented at 7th Symp. on Thermophys. Properties, Gaithersburg, Md., 10-12 May 1977; sponsored by NBS
(Contract W-7405-eng-48)
(UCRL-78782; CONF-770537-8) Avail: NTIS HC A02/MF A01

Thermophysical data are presented for liquid niobium up to approximately 6000 K and for liquid lead up to approximately 5000 K. These new results are summarized along with previously obtained high temperature data for liquid molybdenum, tantalum, tungsten, and uranium.
ERA

N78-18201# Sulzer Bros. Ltd., Winterthur (Switzerland). Abt. Forschung und Entwicklung.
MICROSTRUCTURE STABILITY OF HIGH TEMPERATURE CAST AND FORGED ALLOYS ON Ni BASIS European Concerted Action, Cost 50 - Materials for Gas Turbines. Final Report [GEFUEGESTABILITAET VON HOCHWARMFESTEN GUSS- UND SCHMIEDELEGIERUNGEN AUF Ni-BASIS]
E. Erdoes, T. Geiger, M. Lorenz, F. Staub, and P. Wellner Jul. 1977 57 p refs In GERMAN Orignal contains color photographs
Avail: NTIS HC A04/MF A01

Long term annealing (up to 10,000 h) and characterization of phase changes, and the manufacturing of directionally solidified samples of IN 738 LC, were carried out to determine phase stability and creep behavior in comparison to normally solidified samples. Similar tests are reported on the forged alloy IN 597 and the corresponding cast alloy IN 935, cast alloy IN 939, and forged and cast variants of IN 718. Results indicate that exact microstructure stability limits are difficult to determine

because of the coarse gradation between separate alloy variants and that exact prediction of this stability, based on the overall chemical composition, is not feasible. ESA

N78-18202# National Physical Lab., Teddington (England). Div. of Material Applications.
NPL 7 CREEP DAMAGE IN Ni-Cr BASE ALLOYS European Concerted Action. Cost 50 - Materials for Gas Turbines. Final Report
H. R. Tipler, R. K. Varma, and M. S. Loveday Oct. 1976 89 p refs
(NPL-DMA-246) Avail: NTIS HC A05/MF A01

The creep fracture behavior of the Ni-Cr-base alloys IN738LC (cast alloy) and IN597 (wrought) is discussed. Specimens fractured in creep and test pieces coded from various stages of the creep curve at a given stress were examined metallographically. Creep damage was estimated from measurements of cavitation and cracking of the grain boundaries. Results show that creep damage accumulates with time. The cavitation distribution was fairly uniform along the gage length of the specimens. Cavitation is clearly identified as the only damage leading to failure for the test conditions used. The parameter used to correlate damage with creep behavior varies linearly with the product of strain and time. On cast alloy IN738LC only a limited test program was carried out. ESA

N78-18203# European Space Agency, Paris (France).
INFLUENCE OF MICROSTRUCTURE ON FATIGUE CRACK PROPAGATION RATE OF ALUMINIUM ALLOYS
Joachim Albrecht and Gerd Luetjering Jan. 1978 97 p refs Transl. into ENGLISH of 'Einfluss der Mikrostruktur auf die Ermuedungsrissausbreitung in Aluminiumlegierungen', DFVLR, Cologne Report DLR-FB-77-07, 15 Mar. 1977 Original German report available from DFVLR, Cologne DM 40,70
(ESA-TT-418; DLR-FB-77-07) Avail: NTIS HC A05/MF A01

Investigations were carried out for three different AlZnMgCu-alloys with similar tensile properties. Tests were performed under vacuum and in laboratory air to estimate the influence of environment. A pronounced influence of microstructure on crack propagation rate was found for fatigue under vacuum as well as in air. Crack propagation along slip bands in a high-purity underaged alloy exhibited the slowest, crack propagation by void coalescence in commercial alloys the highest crack propagation rate. At low rates a strong tendency for crack propagation along slip bands was observed. The quantitative investigation of the plastic zone ahead of the crack tip showed a very narrow region of high deformation followed by a long-range zone of low deformation. The effect of environment proved to be dependent on the micromechanism of crack propagation. Author (ESA)

N78-18204# European Space Agency, Paris (France).
STRESS CORROSION AND REPASSIVATION BEHAVIOR OF AUSTENITIC STAINLESS STEELS IN BOILING MgCl2 SOLUTION
Horst Buhl and Paul Kuhn Jan. 1978 61 p refs Transl. into ENGLISH of 'Spannungsrisskorrosions - u. repassivierungsverhalten austenitischer Chrom-Nickelstaehle in siedender MgCl2-Loesung', DFVLR, Cologne Report DLR-FB-77-19, 16 May 1977 Original report in GERMAN previously announced as N78-14160 Original German report available from DFVLR, Cologne DM 29,30
(ESA-TT-437; DLR-FB-77-19) Avail: NTIS HC A04/MF A01

The stress corrosion susceptibility of the two austenitic stainless steels X 5 CrNi 18 9 (material no. 1.4301) and X 10 CrNiMoTi 18 10 (1.4571) was investigated in boiling MgCl2 solution using the constant strain rate test method. The investigations were completed by repassivation measurements in the same environment. Test results show the susceptibility of both materials to SCC. The critical potentials were found at -150 mV sub H for the 1.4301 material and -140 mV sub H for 1.4571. This means full agreement with the results of conventional constant load tests. Information on the incubation period received from the number of cracks agrees with the results of other investigations in this range. The crack growth velocity seems to show a maximum at a characteristic strain rate. The repassivation investigations show an increasing repassivation time starting at the critical potentials in the direction of more positive polarization. This confirms the relation between SCC and repassivation. The information velocity of the first compact passive layer and the growth rate of this passive layer are faster at the molybdenum containing steel 1.4571 than the molybdenum free steel 1.4301. Author (ESA)

N78-18205# Bureau of Mines, Washington, D. C.
MANGANESE - 1977 Mineral Commodity Profiles
Gilbert L. DeHuff and Thomas S. Jones Oct. 1977 23 p refs (PB-274070/2; BM-MCP-7) Avail: NTIS HC A02/MF A01 CSCL 08I

A comprehensive description and analysis of the manganese industry is given with pertinent references from mining through preparation and use of primary and intermediate forms of manganese as metal, alloy, and oxide. Included is information on industry structure size, organization, and geographic distribution; definitions, grades, and specifications; reserves and resources; geology; production and capacity; technology; uses; economic and operating factors and problems; strategic relationships; supply-demand relationships; and forecasts of supply and demand. Manganese is an essential element in steelmaking, its major use, and has other important uses. Demand varies in direct proportion with steel production, and substitution is not feasible for that use. Except for stocks, the United States is almost completely dependent on foreign sources of supply. However, many foreign sources exist, and manganese may become available from deep-sea deposits of manganese nodules. For many years the United States has processed ore into usable forms, but the proportion of manganese imported in up-graded form is increasing significantly. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N78-18206 Florida Univ., Gainesville.
TEMPERATURE DEPENDENCE OF JET SWELL AND MATERIAL FUNCTIONS IN POLYMER MELT SYSTEMS Ph.D. Thesis
Malcolm C. Johnson, Jr. 1977 205 p
Avail: Univ. Microfilms Order No. 77-29257

The prediction of jet swell (JS) magnitude was accomplished in two steps. First, the recoverable shear was calculated at the conditions of interest using a newly developed constitutive theory. Secondly, this quantity was related to JS magnitude using the previously developed, long length to diameter ratio of elastic solid theories with appropriate modifications. Predictions with respect to deformation rate magnitude and temperature were possible with this technique. The major contributions of this research were the new capability of predicting JS magnitude as a function of temperature, and the successful testing of a constitutive theory capable of making improved predictions of material functions in simple shear flow. Dissert. Abstr.

N78-18207 Florida Univ., Gainesville.
MECHANISMS AND KINETICS OF BINARY ALKALI SILICATE GLASS CORROSION Ph.D. Thesis
Edwin Clark Ethridge 1977 338 p
Avail: Univ. Microfilms Order No. 77-29241

An extensive critical review of the glass corrosion and related literature is presented. Many irregularities are noted and some of the previously reported information is reinterpreted. Specific questions are raised which are discussed in detail. Corroded glass surfaces are examined by infrared reflection spectroscopy (IRRS) and techniques are developed for compositional analysis of corroded binary alkali silicate glass surfaces and for the determination of the leached layer compositional profiles. An equation is developed for calculating the thickness of the leached layer from the surface composition and epsilon. The temperature dependent corrosion kinetics for two glasses are presented. Variation of the surface area of glass to volume of solution (A/V) on glass corrosion kinetics is investigated. Graphs of log (time to reach a critical extent of corrosion) vs. log A/V and temperature studies are discussed. Dissert. Abstr.

N78-18208 Iowa State Univ. of Science and Technology, Ames.
EFFECT OF DRAWING ATMOSPHERE ON SURFACE CHARACTERISTICS OF GLASS FIBERS Ph.D. Thesis
Mufit Akinc 1977 194 p
Avail: Univ. Microfilms Order No. 77-29822

Adsorption isotherm and infrared absorption experiments were used. E-glass and soda-lime-silica glass fibers were produced in controlled carbontetra-fluoride in air and water vapor in air atmospheres. A pore structure analysis method, corrected for external area, was developed and pore size distributions for the surfaces were obtained from sorption data. Fiber tensile strength was correlated with the surface area of macropores. An equation was derived from combination of Clausius-Clapeyron and Kelvin equations to relate heat of adsorption to curvature of the surface. Infrared spectroscopy showed that E-glass surfaces were mainly comprised of boranol and silanol groups. Dissert. Abstr.

N78-18209 Connecticut Univ., Storrs.
CHEMICAL DEGRADATION AND STRESS-CRACKING OF DRAWN POLY(ETHYLENE TEREPHTHALATE) FIBERS Ph.D. Thesis
Gregory Eugene Sweet 1977 153 p
Avail: Univ. Microfilms Order No. 77-31227

Several primary amines were used as selective degradative etchants for the investigation of poly(ethylene terephthalate) (PET) morphology. These included 40% aqueous methylamine, 70% to 40% aqueous ethylamine and pure n-propylamine. Weight loss and X-ray diffraction data show that certain concentrations of aqueous amine solutions simultaneously degrade and crystallize PET. The observation indicates the hazards of using certain amine reagents to characterize PET morphology, since the crystalline structure found after etching is likely to be a result of solvent induced crystallization during degradation. Data for 40% aqueous methylamine used at room temperature shows that crystallization does not occur during etching. Dissert. Abstr.

N78-18210 Massachusetts Univ., Amherst.
REACTION KINETICS AND STRUCTURE OF ENZYME MACROMOLECULES SUBJECTED TO HYDRODYNAMIC SHEARING FORCES: ENZYME MECHANOCHEMISTRY Ph.D. Thesis
Matthew Vincent Tirrell 1977 306 p
Avail: Univ. Microfilms Order No. 77-30596

The kinetics of the urease catalyzed hydrolysis of urea occurring in deforming reaction media were studied. When effects on the kinetics due to shearing were observed, ancillary analytical techniques were employed in an attempt to learn about the structural changes responsible. The proposed mechanism of the irreversible inactivation due to shearing is a shear promoted, metal ion catalyzed oxidation of an essential sulfhydryl group(s) on urease. Evidence that the metal ion responsible is adventitious ferric ion has been obtained as well. Viscometric measurements have been combined with a recently proposed theory to show that the urease oligomers are linearly arranged. This may be related to their shear susceptibility. Dissert. Abstr.

N78-18211# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE QUESTION OF DETERMINING THE TEMPERATURE SHIFT FUNCTION IN THE LINEAR THERMOVISCOELASTICITY DOMAIN
V. N. Efimova and R. D. Maksimov [1978] 4 p refs Transl. into ENGLISH form Mekh. Polim. (Latvia), no. 4, 1977 p 718-720
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

To verify the conservation of the temperature-time analogy in the quasistatic strain of polymer materials, tests were conducted for creep or stress relaxation. A method of determining the temperature shift function by means of the family of sigma equivalent xi curves obtained for different constant temperatures and a fixed loading rate was proposed. Thermomechanical curves obtained for temperatures varying linearly were used for the same purpose. These proposed methods are discussed on the basis of an analysis of the phenomenological relationships of linear thermoviscoelasticity. Author

N78-18212*# Fairchild Republic Co., Farmingdale, N. Y.
SPACECRAFT DISINFECTANT/CLEANSING AGENT DEVELOPMENT Final Report
M. Abbate 30 Dec. 1977 48 p
(Contract NAS9-14769)
(NASA-CR-151628; RD177R4001) Avail: NTIS HC A03/MF A01 CSCL 11K

The sanitation agent container, which was selected in a trade off study, employs two chambers, a rigid outer container and an inner flexible bladder. The bladder contains the sanitation agent formulation and its release is controlled by a manually operated valve. The outer container holds a high pressure vapor. There is no void in the bladder which makes the package operation independent of orientation and therefore usable in zero gravity. Foam is developed by a low boiling point fluid or dissolved in the product. When the product is dispensed at atmospheric pressure, the evolved gas or vapor whips up a goam in the valve. The sanitation agents were initially formulated with freons which produces an excellent foam. However freon is incompatible with the life support system and was replaced with carbon dioxide dissolved at high pressure. The CO2 system may limit high temperature exposure to prevent leakage or package distortion. The sanitation agents have been shown to be effective in cleaning soils from personnel and material. Author

N78-18213*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EFFECT OF HYDRAULIC FLUID (MIL-H-83282) ON SELECTED COMMERCIAL O-RING COMPOUNDS
T. E. Wood and W. P. Stone Jan. 1978 22 p
(NASA-TM-78154) Avail: NTIS HC A02/MF A01 CSCL 11A

Acrylonitrile and fluorocarbon compounds were evaluated at various temperatures and time intervals in samples of the fluid obtained from three qualified suppliers. It was concluded that both polymers can function in hydraulic fluids within the conditions defined by this study. Hydraulic fluid from each manufacturer was similar in its effect upon each given O-ring material, with one exception. Similarly, there were no striking differences in the resistance of O-rings of the same generic rubber type when provided by the different manufacturers. Author

N78-18214# Army Materials and Mechanics Research Center, Watertown, Mass.
TITANIUM DIBORIDE ELECTRODEPOSITED COATINGS Final Report
Jordan D. Kellner, William J. Croft, and Lawrence A. Shepard Jun. 1977 12 p refs
(DA Proj. 1T1-62102-AH-84)
(AD-A047956; AMMRC-TR-77-17) Avail: NTIS HC A02/MF A01 CSCL 11/3

A method of electrodepositing titanium diboride from a low temperature fused salt bath is described. Several applications including the coating of tools are presented. Tests have been run on these tools. A statistical analysis of this data shows a significant increase in tool life in drills, inserts, and end mills when coated with 0.3 mil of TiB2, especially when used on fiberglass workpieces. Cost comparisons for selected production machining operations are presented and show that significant overall savings, including tool costs and labor costs for setup and operation, can be realized through the use of tools coated with electrodeposited TiB2. A laser protection application and an erosion protection application are described. Author (GRA)

N78-18215# Battelle Columbus Labs., Ohio.
STRENGTH ANALYSIS OF BRITTLE MATERIALS Final Report, Apr. 1973 - Oct. 1977
G. K. Bansal, W. H. Duckworth, and D. E. Niesz Nov. 1977 69 p refs
(Contract N00014-73-C-0408)
(AD-A048188) Avail: NTIS HC A04/MF A01 CSCL 11/2

Fracture stresses in specimens of four commercial polycrystalline ceramics differing in each linear dimension by a factor of four or five were measured at room temperature under controlled conditions. Data obtained were analyzed with the aid of fractographic examinations for applicability of Weibull statistics. A central problem in attempting to use ceramic materials in demanding structural applications is uncertainty about the stresses to which they can be safely subjected. A ceramic rarely, if ever, exhibits a characteristic failure stress. This stress depends on the nature and distribution of microscopic flaws that intensify

stress locally, and fracture initiates at a single 'worst' flaw when Griffith's criterion for crack instability is met. Within the basic framework, theories are available for treating effects of time, size, and stress distribution on failure stress. This paper reviews these theories, and discusses their use in specifying limiting stresses in designing structural members. Author (GRA)

N78-18216# Army Materials and Mechanics Research Center, Watertown, Mass. Ceramics Research Div.

SURVEY OF CERAMIC REFRACTORY PROBLEMS AND MATERIALS SHORTAGES Final Report

George M. Harris and Beverly Lees Sep. 1977 32 p
(DA Proj. 1T1-62105-AH-84)
(AD-A048108; AMMRC-MS-77-9) Avail: NTIS HC A03/MF A01 CSCL 11/2

This report summarizes 171 replies to a questionnaire requesting information on ceramic material shortages and problems with ceramic refractories experienced by metal smelting and metalworking companies. Raw material shortages consist of seven ores; the main problems appear to be with imported materials. Problems range from depletion of the supply to sole source control of quantity. The problems relating to refractory usage within the metals industries are detailed according to industry and end-item application. Recommendations and possible solutions are included. Author (GRA)

N78-18217# Columbia Univ., New York. Lubrication Research Lab.

A REVIEW OF THEORIES FOR THE FLUID DYNAMIC EFFECTS OF ROUGHNESS ON LAMINAR LUBRICATING FILMS

Harold G. Elrod Dec. 1977 60 p refs
(Contract N00014-76-C-0105)
(AD-A048333; Rept-27) Avail: NTIS HC A04/MF A01 CSCL 11/8

This report contains a comprehensive survey of theoretical work on the fluid dynamic effects of roughness in lubrication. Of necessity, much of the report deals with Reynolds roughness; that is, roughness which can be locally analyzed with Reynolds equations because the wavelength of the roughness is not too short. One-sided and two-sided striated roughnesses are considered. Statistical and multiple-scale treatments are discussed and intercompared. Finally, the effects of short-wavelength roughness (Stokes roughness) are treated, as well as the consequences of slip in highly rarefied situations. Some new results for isotropic Reynolds roughness, for Stokes roughness, and for molecular slip are given preliminary exposure.
Author (GRA)

N78-18218# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.

OXIDATIVE STABILIZATION OF ACRYLIC FIBERS. 3: STABILIZATION DYNAMICS

S. B. Warner, L. H. Peebles, Jr., and D. R. Uhlmann 10 Jan. 1978 36 p refs
(Contract N00014-75-C-0542)
(AD-A048746; TR-9) Avail: NTIS HC A03/MF A01 CSCL 11/5

As acrylic fibers are heated in air to induce the stabilization reactions, the tension developed when stabilized at constant length and the instantaneous velocity of stabilizing fibers undergoing continuous processing both depend on the chemical composition, diameter, and orientation of the precursor fiber. An oriented fiber will tend to shrink when heated to the range of 130-160 C, and hence will develop tension if restrained at constant length. Although this process has no direct relation to the stabilization process, it will influence the instantaneous velocity of the fiber during the later stages of continuous processing. As a fiber held at constant length is heated above 160 C the tension developed by entropic relaxation decreases and the fiber starts to undergo the prefatory and sequent reactions of stabilization described in the first paper in this series. If the prefatory reactions are rapid, a rigid structure is quickly established in the fiber and tension again increases rapidly. However, if the prefatory reactions are slow, select portions of the fiber react preferentially and the unreacted portions tend to relax to maintain a temporary quasi-equilibrium tension level. In both cases the fibers shrink at the later stages of stabilization because of chemical reactions. The shape of the tension-time curve is similar to the oxygen-uptake curves: the diffusion-limited mechanism of stabilization produces parabolic curves whereas the reaction-limited mechanism produces linear curves. Because each element of a fiber undergoing continuous processing is subjected to the same tension at all times, previously oriented fibers first shrink, then stretch, and finally shrink again. GRA

N78-18219# Princeton Univ., N. J. Dept. of Chemical Engineering.

INVESTIGATION OF THE T SUB LL (< T SUB G) RELAXATION IN HOMOPOLYMERS AND BLOCK COPOLYMERS OF STYRENE BY TORSIONAL BRAID ANALYSIS Technical Report, Dec. 1976 - Dec. 1977

J. K. Gillham and R. F. Boyer Dec. 1977 26 p refs Presented at the Eastern Anal. Symp., Inc. on Polymer and Thermal Analysis, Nov. 1977 Prepared in cooperation with Midland Macromolecular Inst., Mich.
(Contract N00014-76-C-0200)
(AD-A048455; TR-13) Avail: NTIS CSCL 11/9

Investigation of the T sub ll (< T sub g) relaxation in amorphous polymers of styrene by the technique of torsional braid analysis has been reviewed. For the most part the relaxation behaves like the glass transition (T sub g) in its dependence on molecular weight, on average molecular weight in binary polystyrene blends, and on composition in a polystyrene homogeneously plasticized throughout the range of composition. Diblock and triblock copolymers also display a T < Tg relaxation above the Tg of the polystyrene phase. Two results in particular suggest that the T sub ll relaxation is molecularly based. (1) The temperature T sub ll is determined by the number average molecular weight for binary blends of polystyrene when both components have molecular weights below Mc (the critical molecular weight for chain entanglements). (2) Homopolymers, and diblock and triblock copolymers of styrene, have a T < T sub g relaxation at approximately the same temperature when the molecular weight of the styrene block is equal to that of the homopolymer. Author (GRA)

N78-18220# California Univ., Davis. Dept. of Mechanical Engineering.

EFFECT OF TEMPERATURE AND CROSS-LINKINGS ON THE FLOW BEHAVIOR OF A RUBBERIZED EPOXY RESIN Final Technical Report

Amiya K. Mukherjee and Stanley Ling 2 May 1977 54 p refs
(Contract W-7405-eng-48)
(UCRL-13732) Avail: NTIS HC A04/MF A01

Creep and tensile tests were conducted to study the effect of cross-linking and temperature (296K to 406K) on the flow behavior of rubber modified phenolic epoxy resin cured with amine mixture. This epoxy matrix system may be deformed by reorientation of chain segments between cross-links. Deformation in these segments may be restrained by dispersed rubber spheres. Both the creep curves and the activation energy for flow suggest that the degree of cross-linking may have increased during testing. This increase is both temperature and stress aided. Over the conditions studied the flow of such a system can be approximated by: epsilon/sub T/ = A(sigma/sub U//sigma/sub TR/)/sup n/ exp(-Q/sub T//RT), where epsilon/sub T/ is true strain rate, A is the structural factor (a constant), sigma/sub U/ is ultimate stress, sigma/sub TR/ is 'stress transition', n is mechanism dependent stress exponent, Q/sub T/ is true activation energy, R is a gas constant, and T is the absolute temperature. ERA

N78-18221# Paul Sabatier Univ., Toulouse (France). Lab. de Genie Electrique.

THE TREATMENT OF CELLULOSE BY HIGH PRESSURE DISCHARGE

B. Benaissa and C. Mayoux Sep. 1976 9 p refs Presented at the 3d Conf. on Electrode Phenomena in Gas Discharges, Estoril, Port., 1-3 Sep. 1976
Avail: NTIS HC A02/MF A01

The physical and chemical transformations of cellulose fibers subjected to high pressure discharges were investigated. The modifications of molecular structures of treated material, the effect of the general discharge parameters, and the mechanism of the reactions developed between the exposed surface, the

ionized gas, and the electric field are dealt with. The creation of reacting centers at the surface of the material is related to precise species existing in the discharges. Cellulose paste (wood paste with 50 % long fibers and 50 % short fibers) treated by electrical discharges was shown to have notable modifications in molecular structure. ESA

N78-18222# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Munich (West Germany). Inst. fuer Flugtreib- und Schmierstoffe.
STUDY ON THE FORMATION OF REACTION LAYERS ON METAL SURFACES BY USING LUBRICANT ADDITIVES
Heribert Lindinger 14 Jul. 1977 27 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-465)
(DLR-FB-77-31) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 16,10

Tests to prove the formation of reaction layers on metal surfaces by a blended ester base oil under the influence of oxygen or nitrogen as environmental medium are discussed. The base oil used was a pentaerythrite heptane acid ester, and the additions were tricresyl phosphate and oleic acid. Testing was made with the four ball wear tester. Aside from determining friction and wear data, wear areas were investigated with the scanning electron microscope including an additional energy dispersive X-ray analysis, and the Talysurf roughness test equipment. Author (ESA)

N78-18223# European Space Agency, Paris (France).
EXPERIMENTAL AND THEORETICAL STRESS ANALYSIS OF A FIBER REINFORCED PLASTIC TENSILE SPECIMEN WITH A HOLE IN IT
Rainer Schuetze and Hoshang Kharadi Jan. 1978 24 p refs Transl. into ENGLISH of 'Exptl. u. rechnerische Spannungsanal. an einer Zugprobe mit Bohrung aus Faserverbundwerkstoffen', DFVLR, Brunswick Report DLR-FB-77-06, 11 Mar. 1977 Original report in GERMAN previously announced as N77-30248 Original German report available from DFVLR, Cologne DM 3,80
(ESA-TT-417; DLR-FB-77-06) Avail: NTIS HC A02/MF A01

The stress distribution in a glass fiber reinforced plastic tensile specimen containing a hole was calculated and investigated experimentally. The deformations in the vicinity of the hole were measured by holographic interferometry and computed by the finite element method. The stresses resulted from measured and computed deformations. Comparison gave a good agreement between measurement and computed values. Author (ESA)

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N78-18224*# Energetics Science, Inc., Elmsford, N. Y.
A STUDY FOR HYPERGOLIC VAPOR SENSOR DEVELOPMENT Final Report
Joseph R. Stetter and Karen Tellefsen Nov. 1977 82 p refs (Contract NAS10-8982)
(NASA-CR-155770) Avail: NTIS HC A05/MF A01 CSCL 21D

In summary, the following tasks were completed within the scope of this work: (1) a portable Monomethylhydrazine analyzer was developed, designed, fabricated and tested. (2) A portable NO2 analyzer was developed, designed, fabricated and tested. (3) Sampling probes and accessories were designed and fabricated for this instrumentation. (4) Improvements and modifications were made to the model 7630 Ecolyzer in preparation for field testing. (5) Instrument calibration procedures and hydrazine handling techniques necessary to the successful application of this hardware were developed. Author

N78-18225# Naval Surface Weapons Center, White Oak, Md. Research and Technology Dept.
DDT BEHAVIOR OF WAXED MIXTURES OF RDX, HMX, AND TETRYL
Donna Price and Richard R. Bernecker 18 Oct. 1977 77 p refs
(ZR0130901; SF33354316)
(AD-A047968L; NSWC/WOL/TR-77-96) Avail: NTIS HC A05/MF A01 CSCL 19/1

DDT data are presented for the 94/6 RDX/wax series over 70% to 97% TMD. The trends are similar to those of the 91/9 RDX/wax series but this mixture has a much shorter time range corresponding to its increased sensitivity. Data are also given for one waxed RDX and two waxed HMX series at fixed percent porosity (100 - % TMD). All mixtures followed the physical model proposed for DDT of 91/9 RDX/wax. However, the series run at fixed % TMD and varying wax content showed strong correlations between the relative time to detonation and the predetonation column length. No similar correlation appears at fixed composition and varying porosity. Author (GRA)

N78-18226# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.
COMPARISON TESTS ON THE 100-GPM ELECTROKINETIC FUEL DECONTAMINATOR AND A 100-GPM MILITARY STANDARD FILTER/SEPARATOR Final Technical Report
William R. Williams Sep. 1977 35 p
(AD-A048655; MERADCOM-2220) Avail: NTIS HC A03/MF A01 CSCL 21/4

This report covers identical tests performed on the 100-GPM Electrokinetic Fuel Decontaminator and a 100-GPM Military Standard Filter/Separator for the purpose of comparing performances. Performance is based upon the ability to remove emulsified water from fuel. Test fuels were turbine fuel JP-5 and diesel fuel No. 2. Water is injected into the fuel upstream of a centrifugal pump out of the test vessel in concentrations of 0.5, 2, 5, and 10%. The effluent, pressure-drop readings are also taken. The effluent fuel from each test vessel is measured for water concentration using a turbidimeter. Tests are performed at ambient temperatures and low temperatures. Results are correlated, and the performances of the two test vessels are compared. Conclusions are as follows: (a) The Electrokinetic Fuel Decontaminator demonstrates improved, overall efficiency in removing water from turbine fuel and diesel fuel over the currently used Military Standard Filter/Separator. (b) The Electronkinetic Fuel Decontaminator demonstrates a lower, overall pressure drop than the Military Standard Filter/Separator. (c) The power consumption of the Electrokinetic Fuel Decontaminator is primarily dependent on the amount of water present and, to a lesser extent, on temperature. (d) The power consumption for decontaminating diesel fuel is approximately three times as great as that for decontaminating turbine fuel. (e) The current necessary to remove 1 gallon of water from turbine fuel is approximately 1 ampere; for diesel fuel, the current is approximately 3 amperes. Author (GRA)

N78-18227# Systems Science and Software, La Jolla, Calif.
PENETRATION OF HIGH EXPLOSIVES BY INERT PROJECTILES Final Report, 17 May 1976 - 16 Jul. 1977
M. H. Rice Nov. 1977 32 p refs
(Contract DAAG29-76-C-0049)
(AD-A048326; SSS-R-78-3512; ARO-13799.1-EX) Avail: NTIS HC A03/MF A01 CSCL 19/1

A series of two-dimensional calculations has been carried out for the penetration of the high explosives PBX-9404 and Composition B by steel spheres. Equations-of-state and reaction-rate models are presented which, when used in the two-dimensional HELP code, result in good agreement with the observed velocity-loss data and detonation thresholds.
Author (GRA)

N78-18228# Staatliches Forschungsinstitut fuer Geochemie, Bamberg (West Germany).
INVESTIGATIONS OF ROCKET PROPELLANTS USING TRACERS. LIFE TESTING OF PLASTIC PROPELLANT GASES [UNTERSUCHUNGEN VON RAKETENTREIBSTOFFEN MITTELS MARKIERTER SUBSTANZEN. PRUEFUNG DER LEBENSDAUER VON TREIBSATZISOLATIONEN]
H. Meier, D. Boesche, and G. Zeitler Bonn DOKZENTBw 1977 71 p refs In GERMAN; ENGLISH summary
(Contract T/RF-51/RF-510/41084)
(BMVg-FBWT-77-14) Avail: NTIS HC A04/MF A01;

DOKZENTBw DM 30

The migration of nitroglycerin in polymers was investigated with a view to determining the useful life of solid propellants, using the radioisotope tracer technique. When the propellant's nitroglycerin component is labelled with carbon 14, the distribution of nitroglycerin in plastics can be measured by means of the profile sectioning technique in conjunction with beta scintillation metering. The quantity of nitroglycerin migrating into the various plastic materials at given temperature and for given storage periods can be predicted. Results obtained allow identification of the mechanics characteristic of the migration of nitroglycerin from the propellant to the polymers phase. ESA

N78-18229# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Trauen (West Germany). Inst. fuer Chemische Antriebe und Verfahrenstechnik.

BORON COMBUSTION IN COMBINATORY PROPULSION [BORVERBRENNUNG IN KOMBINATIONSANTRIEBEN]

A. Boussios 1977 13 p refs In GERMAN Report will also be announced as translation (ESA-TT-462)

(DLR-IB-456-77/8) Avail: NTIS HC A02/MF A01

The application of boron, to replace kerosine, in combination propulsion systems is discussed. The state-of-the-art of boron as propellant is presented, the influence of N2O4-N2H4-N2 or N2O4-N2H4 as propellant addition is discussed and the energy yield in comparison with ramjet propulsion is considered. ESA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N78-18230 Iowa Univ., Iowa City.

SUBSTRUCTURING METHODS FOR DESIGN SENSITIVITY ANALYSIS AND STRUCTURAL OPTIMIZATION Ph.D. Thesis

Ashok Kumar Govil 1977 226 p

Avail: Univ. Microfilms Order No. 77-28459

An iterative method is presented for optimal design of large scale structures that incorporates the concept of substructuring. Design sensitivity analysis for the method is developed in a state space setting, in which the symmetry of the structural stiffness matrix is utilized to define efficient adjoint calculations that yield explicit design derivatives. The entire procedure is then presented as a convenient computational algorithm. Applications of the method are given for optimal design of two and three dimensional truss, idealized wing, and framed structures. Computer programs based on the present algorithm are given and numerical results are presented for three truss structures idealized wing structures and three framed structures. It is concluded that the algorithm with substructuring is more efficient than the one without substructuring, with computational time reduced by up to 66%. It is shown that the method is 'general' and computationally efficient. Dissert. Abstr.

N78-18231# Polish Academy of Sciences, Warsaw. Inst. of Fundamental Technological Research.

ARCHIVES OF MECHANICS, VOLUME 29, ISSUE 4

1977 127 p refs

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Research is presented covering the areas of metal fatigue, steady flow through curved fibers and disclinations in micropolar media. Modelling laws for granular material were investigated as were mathematical models representing viscoplastic flow. For individual titles, see N78-18232 through N78-18239.

N78-18232# Polish Academy of Sciences, Warsaw.

ANALYSIS OF THE USEFULNESS OF DIFFUSION EQUATIONS FOR THE DESCRIPTION OF DISLOCATION MOBILITY AND RELATED PHENOMENA c39

S. Pilecki *In its* Arch. of Mech., Vol. 29, Issue 4 1977 p 505-517 refs (For availability see N78-18231 09-31)

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Dislocation motion induced by the process of thermal activation and mechanical loading was considered. An analysis is given of possible reasons explaining that the motion of dislocation is more restricted as compared to point defects. The influence of material properties on the displacements was studied. A good correlation between the theory and experiments indicates the possibility of describing the process by the diffusion equations. Author

N78-18233# Polish Academy of Sciences, Warsaw.

EQUATIONS OF STEADY FLOW THROUGH SLIGHTLY CURVED MULTIFILAMENT BUNDLES c34

A. Szaniawski *In its* Arch. of Mech., Vol. 29, Issue 4 1977 p 519-530 refs (For availability see N78-18231 09-31)

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A steady filtration flow through a multifilament bundle of slightly curved, almost parallel fibers, was considered. The small curvature of fiber lines was due to their high inner longitudinal tension. The presented equations allow the calculation of pressure and velocity fields and forces acting on the fibers. Fiber lines, assumed in the first step as straight lines, may be consecutively determined in the next step by means of corresponding differential equations. An interesting case of flow through a multifilament bundle, on which particular attention is paid, is transversal flow. In transversal flow, all longitudinal components of gradients being very small, the filtration relative to the bundle occurs across the fiber lines. The wringing of plane or axisymmetrical convergent bundles is presented as an example. The equations describing flow through straight parallel fibers are also presented. Author

N78-18234# Polish Academy of Sciences, Warsaw.

THEORY OF DISCLINATIONS IN ELASTIC COSSERAT MEDIA c39

J. P. Nowacki *In its* Arch. of Mech., Vol. 29, Issue 4 1977 p 531-545 refs (For availability see N78-18231 09-31)

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The concept of disclinations in a micropolar Cosserat medium was examined. The starting point was the surface model of Volterra which determines the disclination by means of displacement discontinuities at a certain surface sigma. Green's functions were used to derive the general formulae for the displacement u and rotation phi fields. The displacement discontinuity was then modelled by a suitable distribution of body forces and couples at the surface sigma. Transition from distortions to disclinations was shown and the distortional model of a disclination was constructed. In the concluding section, effective solutions for the displacement u and rotation fields phi were derived in the cases of the fundamental types of disclinations. Author

N78-18235# Technical Univ. of Denmark, Lyngby. Structural Research Lab.

MODEL LAWS FOR GRANULAR MEDIA AND POWDERS WITH A SPECIAL VIEW TO SILO MODELS c39

J. Nielsen *In* Polish Acad. of Sci. Arch. of Mech., Vol. 29, Issue 4 1977 p 547-560 refs Presented at the Euromech. Colloq. 84 on Mech. of Granular Mater., Warsaw, Jul. 1976 (For availability see N78-18231 09-31)

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A Continuation of earlier work on silo structures is described. On the basis of very general basic equations, two model laws are given, one corresponding to the individual particles of the particulate material being similar in the same ratio as the remaining geometry, and the other corresponding to the use of the same particles in the model and prototype. Account is taken of both time-dependent material properties in the particulate medium and the effect of the pore medium on the stress and strain field. The model laws contain the requirement to an increased, homogeneous gravitational field, and an account is given of the errors that arise if, instead, a gravitational field produced in a centrifuge is used. Finally, the question of the degree to which the model conditions can be satisfied for various group materials is discussed. The results can be widely applied to other problems relevant to particulate media. Author

N78-18236# Technische Hogeschool, Delft (Netherlands). Dept. of Civil Engineering.

MATHEMATICAL ELABORATION OF THE DOUBLE SLIDING, FREE ROTATING MODEL c39

G. DeJosselinDeJong *In* Polish Acad. of Sci. Arch. of Mech., Vol. 29, Issue 4 1977 p 561-591 refs Presented at the

Euromech. Colloq. 84 on Mech. of Granular Mater., Warsaw, Jul. 1976 (For availability see N78-18231 09-31)
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The theoretical foundations and development of a rigid, perfectly plastic model describing the flow of an ideally granular medium were studied. The approach used is based on the coincidence of slip lines with planes on which the yield condition, appropriate for granular media, takes the form of a friction law. As a consequence of such an assumption, the principal directions of strain rate and stress tensors may deviate. In addition, a nonuniqueness of the solution of boundary value problems resulted, the only restriction on the solution being imposed by the condition of energy dissipation. A discussion of basic assumptions, an analysis of the type of governing differential equations and properties of discontinuity lines in velocities, and a description of a technique of constructing the velocity field with the respective restrictions imposed on this field, are presented. Author

N78-18237# Warsaw Univ. (Poland). Inst. of Mechanics.
ON THE NON-STANDARD FORMULATION OF MECHANICS **c37**
Cz. Wozniak *In* Polish Acad. of Sci. Arch. of Mech., Vol. 29, Issue 4 1977 p 593-605 refs (For availability see N78-18231 09-31)
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In the known formulations of mechanics, real bodies are represented either by discrete sets of material points or by material continua. A more general model of the real bodies is introduced, which includes both discrete and continuous material systems as special cases. The approach is based on the reinterpretation of the relations of classical mechanics from the point of view of nonstandard analysis. Author

N78-18238# Polish Academy of Sciences, Warsaw.
COUPLING OF DISSIPATIVE MECHANISMS OF VISCOPLASTIC FLOW **c34**
P. Perzyna *In its* Arch. of Mech., Vol. 29, Issue 4 1977 p 607-624 refs Presented at the 14th IUTAM Congr., Delft, Netherlands, 30 Aug. - 4 Sep. 1976 (For availability see N78-18231 09-31)
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Coupling effects between dissipative mechanisms of an elastic-viscoplastic material were described. A reasonable and physically justified theory of viscoplasticity within the framework of a material structure with internal state variables was constructed. The internal friction, the thermally activated and the high velocity dislocation damping mechanisms were emphasized. A discussion of coupling of dissipative effects for these mechanisms is presented and two groups of internal state variables are introduced. It was shown that the group of internal state variables describing dissipative effects of the internal friction mechanism can be eliminated. In this case, the evolution equations for a plastic flow mechanism were modified in such a way that the influence of internal friction effects are taken into account. The evolution equations for internal state variables describing the main mechanism take the form of integral or integro-differential equations. One dimensional examples were considered. Experimental results for titanium, aluminum, and copper were used to choose functions involved in the description. Author

N78-18239# Polish Academy of Sciences, Warsaw.
FIELD EQUATIONS FOR MICROPOLAR CURRENT AND A HEAT CONDUCTING MAGNETICALLY-SATURATED SOLID **c39**
N. Naerlovic-Veljkovic *In its* Arch. of Mech., Vol. 29, Issue 4 1977 p 625-630 refs (For availability see N78-18231 09-31)
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The equations of motion, boundary conditions and the energy equation were derived starting from the balance of magnetization and the balance of energy. Constitutive equations and the dissipation inequality were obtained assuming the existence of internal state variables and postulating the entropy equation. Author

N78-18240 Polish Academy of Sciences, Warsaw. Inst. of Fundamental Technological Research.
ARCHIVES OF MECHANICS, VOLUME 29, ISSUE 5 1977 115 p refs
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Articles on the following topics are reported: (1) disclination kinematics; (2) restrictions on heat conduction in simple materials; (3) quasi-perfect elasticity (theoretical foundations); (4) preliminary experiment on acoustoelasticity for stress analysis; (5) plasticity of polycrystal; (6) forces in material space; (7) existence of solutions for the prestressed nonlinear orthotropic heated plates; and (8) diffusion in dislocation fields. Also presented are brief notes on the incompressible micropolar fluids. For individual titles, see N78-18241 through N78-18249.

N78-18241 Polish Academy of Sciences, Warsaw. Inst. of Fundamental Technological Research.
DISCLINATION KINEMATICS **c39**
E. Kossecka and R. DeWit (NBS, Wash., D. C.) *In its* Arch. of Mech., Vol. 29, Issue 5 1977 p 633-651 refs (For availability see N78-18240 09-31)
Copyright. Avail: Issuing Activity

A mathematical theory of moving disclinations is developed. Kinematics is derived for a continuous distribution of disclinations and dislocations as well as for moving discrete disclination and dislocation lines. The concept of the plastic velocity is used to give the theory a symmetrical form. The new concepts of disclination and dislocation loop currents are introduced. The relation between the disclination theory and the incompatibility theory is given. Author

N78-18242 East Anglia Univ., Norwich (England). School of Mathematics and Physics.
RESTRICTIONS ON HEAT CONDUCTION IN SIMPLE MATERIALS **c34**
P. Chadwick *In* Polish Acad. of Sci. Arch. of Mech., Vol 29, Issue 5 1977 p 653-658 refs (For availability see N78-18240 09-31)
Copyright. Avail: Issuing Activity

It is shown that a strong conductivity condition represents a physically plausible property of heat-conducting materials and provides a means of interpreting and collating other restrictions on thermal conduction in simple materials which have been proposed. Author

N78-18243 Oxford Univ. (England). Mathematical Inst.
QUASI-PERFECT ELASTICITY. 1: THEORETICAL FOUNDATIONS **c39**
A. Paglietti (Cagliari Univ., Italy) *In* Polish Acad. of Sci. Arch. of Mech., Vol. 29, Issue 5 1977 p 659-672 refs Sponsored by NATO (For availability see N78-18240 09-31)
Copyright. Avail: Issuing Activity

The standard thermodynamic theory of elastic materials is deficient in several respects. Some of its shortcomings are the following: it leads to systematic errors in the determination of the temperature variations produced by adiabatic processes, it does not predict, contrarily to the experimental evidence, any increment of temperature for a material undergoing rapid (adiabatic) cycles of deformation; it does not imply any limit to the elastic behavior of the material. The aim of the present study is to provide a theory which not only is in agreement with the results of the commonly accepted theory of elasticity whenever the latter are in conformity with the experimental evidence, but which is also free of the above shortcomings. This article is devoted to the theoretical foundations; the article shows how the proposed approach can be supported on experimental grounds and exploited to obtain a correct answer to the problems where the standard theory fails. Author

N78-18244 Polish Academy of Sciences, Warsaw. Faculty of Engineering Science.
PRELIMINARY EXPERIMENT ON ACOUSTOELASTICITY FOR STRESS ANALYSIS **c39**
H. Fukuoka and H. Toda *In its* Arch. of Mech., Vol. 29, Issue 5 1977 p 673-686 refs (For availability see N78-18240 09-31)
Copyright. Avail: Issuing Activity

An experimental technique for stress analysis is described which makes use of a polarized ultrasonic transverse waves traversing a metal specimen under applied stress. The technique employs a 5 MHz shear transducer on rotatable mounting as

the transmitter and the receiver of ultrasonic pulses. Aluminum pure iron and copper materials are used as specimens. Ultrasonic pulses are polarized parallel to and perpendicular to the direction of the applied uniaxial stress. The main features of the results are as follows: (1) for aluminum and pure iron the ultrasonic velocity varies linearly to the applied stress, (2) for the copper specimen the ultrasonic velocity varies parabolically with the applied stress and decreases both for compressive and tensile stresses. Thus, a theory to explain the results for copper must take the fourth-order elastic constants into account for the energy density function for isotropic material, and (3) in stress free state, ultrasonic shear velocities polarized parallel to the rolling direction of the original material are always faster than those perpendicular to it for all three materials. These effects are due to the structural anisotropy for rolled material. Author

N78-18245 Polish Academy of Sciences, Warsaw. Inst. of Fundamental Technological Research.
PLASTICITY OF POLYCRYSTAL **c76**
Cz. Eimer *In its* Arch. of Mech., Vol. 29 Issue 5 1977 p 687-703 refs Presented at IUTAM Colloq. EUROMECH 71, The Bulk Properties of Composite Mater., Bath, Engl. (For availability see N78-18240 09-31)
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Constitutive relations for polycrystal in elastic-plastic range were derived where plastic strains are produced by slips in crystallites. The slip criterion and strain-hardening law for monocrystal in the given crystallographic class in particular, Schmid's law was applied and the relevant plastic yield hypersurface analyzed. The geometry was described by probabilistic methods. The fields of stress and strain produced by plastic distortions were taken into account without any simplifications and this is the essential of the generalization towards previous methods. The solution was based on variational theorems of plasticity. A numerical procedure was outlined using nonlinear programming methods the grains being divided in subregions of approximately homogeneous distortions; thus consecutive points of sigma-epsilon curve were determined. Author

N78-18246 Polish Academy of Sciences, Warsaw. Inst. of Fundamental Technological Research.
FORCES IN MATERIAL SPACE **c39**
D. Rogula *In its* Arch. of Mech., Vol. 29, Issue 5 1977 p 705-713 refs (For availability see N78-18240 09-31)
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The concept of quasi-Newtonian force in the material space was introduced. It was based on dynamic quantities that are related to the Euclidean group of material symmetry of continuous media. Such forces act in the material space in a manner similar to Newtonian forces in the physical space. The quasi-Newtonian forces acting on a dislocation, on a localized inhomogeneity, and on the tip of a crack were determined. The physical interpretation of the forces was given. Author

N78-18247 Nairobi Univ. (Kenya). Dept. of Mathematics.
EXISTENCE OF SOLUTIONS FOR THE PRESTRESSED NON-LINEAR ORTHOTROPIC HEATED PLATES **c39**
B. O. Calleb *In* Polish Acad. of Sci. Arch. of Mech., Vol. 29, Issue 5 1977 p 715-722 refs (For availability see N78-18240 09-31)
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The question of the existence of solutions for the system of equations governing the arbitrarily heated and prestressed nonlinear orthotropic plates was considered. Sufficient conditions for the existence of solutions of the problem by way of a fixed point theorem in an appropriate function space were given. Author

N78-18248 Illinois Univ., Urbana.
DIFFUSION IN DISLOCATION FIELDS **c39**
E. C. Aifantis, D. E. Beskos (Minnesota Univ., Minneapolis), and W. W. Gerberich (Minnesota Univ., Minneapolis) *In* Polish Acad. of Sci. Arch. of Mech., Vol. 29, Issue 5 1977 p 723-740 refs (For availability see N78-18240 09-31)
Copyright. Avail: Issuing Activity

The mechanical interaction effects between a diffusing elastic fluid and a dislocation stress field were studied. Screw and rotational dislocation for both linear and non-linear elastic behavior were considered. The analysis was based on the introduction of an internal diffusive force vector which accounts for the diffusion phenomena. A model was proposed for the form of this diffusive force to meet the physical requirements. The approach was completely innovational in comparison with the traditional procedure applied to these problems, which was based on the concept of elastic interaction energy. Author

N78-18249 Freiburg Univ. (West Germany). Inst. of Applied Mathematics.
THE EXISTENCE OF INSTATIONARY FLOWS IN INCOMPRESSIBLE MICROPOLAR FLUIDS **c34**
H. Lange *In* Polish Acad. of Sci. Arch. of Mech., Vol. 29, Issue 5 1977 p 741-744 refs (For availability see N78-18240 09-31)
Copyright. Avail: Issuing Activity

The main subject of the paper was a discussion of the existence theorems for instationary flows in incompressible micropolar fluids. No detail proofs of these theorems were given. Author

N78-18250# Lockheed Missiles and Space Co., Palo Alto, Calif.
PECULIARITIES OF THE INITIAL STAGE OF A TRANSIENT IN A CRYOGENIC SYSTEM
V. P. Beliakov, S. P. Gorbachev, M. N. Bocharov, and L. P. Ronzhin [1977] 4 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Mashinostr. (USSR), no. 9, 1977 p 60-64
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

A theoretical investigation was made of the beginning of a transient in a cryogenic heat removal system with a vertical adiabatic pipeline. The possibility of the appearance of a second boiling up section is shown in a one-dimensional formulation, and a dependence is obtained for a jump perturbation of the heat load, which permits computation of the conditions at which it is eliminated. Author

N78-18251*# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
EVACUATED LOAD-BEARING HIGH PERFORMANCE INSULATION STUDY Final Report, May 1974 - Aug. 1977
R. T. Parmley and G. R. Cunnington Dec. 1977 264 p refs (Contract NAS3-17817)
(NASA-CR-135342; LMSC-D564116) Avail: NTIS HC A12/MF A01 CSCL 22B

A light weight, vacuum jacketed, load bearing cryogenic insulation system was developed and tested on a 1.17-m (46-in.) spherical test tank. The vacuum jacket consists of 0.08 mm (0.003 in.) thick 321 stainless steel formed into a wedge design that allows elastic jacket movements as the tank shrinks (cools) or expands (warms up or is pressurized). Hollow glass spheres, approximately 80 micrometers in diameter with a bulk density of 0.069 g/cc (4.3 lb cubic foot), provide the insulating qualities and one atmosphere load bearing capability required. The design, fabrication, and test effort developed the manufacturing methods and engineering data needed to scale the system to other tank sizes, shapes, and applications. The program demonstrated that thin wall jackets can be formed and welded to maintain the required vacuum level of .013 Pa yet flex elastically for multiple reuses. No significant shifting or breakage of the microspheres occurred after 13 simulated Space Tug flight cycles on the test tank and a hundred 1 atmosphere load cycles in a flat plate calorimeter. The test data were then scaled to the Space Tug LO2 and LH2 tanks, and weight, thermal performance, payload performance, and costs were compared with a helium purged multilayer insulation system. Author

N78-18252*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EVALUATION OF A LABORATORY TEST MODEL ANNULAR MOMENTUM CONTROL DEVICE
Nelson J. Groom and David E. Terray Mar. 1978 23 p refs (NASA-TP-1142; L-11968) Avail: NTIS HC A02/MF A01 CSCL 14B

A 4068 Nm Sec laboratory test model annular momentum control device (AMCD) was described and static and dynamic test results were presented. An AMCD is a spinning annular

rim suspended by noncontacting magnetic bearings and powered by a noncontacting linear electromagnetic motor. Test results include spin motor torque characteristics and spin motor and magnetic bearing drag losses. Limitations of some of the design approaches taken were also discussed. Author

N78-18253*# National Aeronautics and Space Administration. Pasadena Office, Calif.
A SYSTEM FOR DELIVERING SiCl4 TO A CHEMICAL REACTOR Patent Application
Robert E. Witkowski (Westinghouse Electric, Trafford, Pa.) and Thomas S. Bulischeck, inventors (to NASA) (Westinghouse Electric, Trafford, Pa.) Filed 31 Jan. 1978 19 p
(Contracts NAS7-100; JPL-954589)
(NASA-Case-NPO-14383-1; US-Patent-Appl-SN-873993) Avail: NTIS HC A02/MF A01 CSCL 13H

A system was developed for delivering SiCl4 to the chemical reactor employed in the production of solar grade silicon. The system is characterized by a supply circuit including a tank comprising a source of high purity SiCl4 and a pressurized delivery loop connected between the source and a reactor for delivering SiCl4 under pressure to the reactor. A gas cover circuit is connected to the supply circuit for introducing an inert dry cover gas into the source of SiCl4 for maintaining purity. A quality control system including an analyzer connected with the supply circuit is used for detecting the presence of by-products of hydrolysis within the supply circuit and an analyzer connected with the cover gas circuit is provided for detecting the presence of moisture in the cover gas. Additionally, a further monitoring system is provided for purposes of extracting quantities of SiCl4 to be examined for metallic chlorides, oxides and the like. NASA

N78-18254# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abt. Kunststoffe.
TECHNOLOGICAL AND EXPERIMENTAL INVESTIGATIONS OF WINDOW FRAMES IN FRP WINDING PRESS TECHNOLOGY [TECHNOLOGISCHE UND EXPERIMENTELLE UNTERSUCHUNGEN AM FENSTERRAHMEN IN FK-WICKELPRESSTECHNIK]
M. Gaedke and G. Niederstadt 1977 39 p refs In GERMAN
Original contains color illustrations
(DLR-IB-152-77/10) Avail: NTIS HC A03/MF A01

The development and manufacturing of window frames in pressed fiber reinforced plastics with a wound support structure is reported. The materials selected for the support structure were epoxy resin - novolake and polyimide resin 353 in view of a requirement on thermal stability. Materials selected for reinforcement were carbon fibers, hollow glass fibers and Kevlar, and these were used in several combinations for manufacturing of the frame. Stiffness tests and electron microscope investigations were carried out for sample frames. Indications are provided for further manufacturing of carbon fiber/glass fiber combinations. ESA

N78-18255# Oxford Univ. (England). Cryogenics Lab.
A MULTI-PURPOSE CRYOSTAT FOR FREEZING BIOLOGICAL MATERIALS
W. B. Bald May 1977 51 p refs
(OUEL-1195/77) Avail: NTIS HC A04/MF A01

The design, construction, and preliminary testing of a low temperature cryostat capable of freezing biological materials in a controlled and reproducible manner are described. By introducing slight modifications to the cryostat it is possible to carry out freezing experiments up to about 2 cm diameter using one of three different cooling processes. ESA

N78-18256# National Bureau of Standards, Washington, D. C. Inst. for Basic Standards.
THE NATIONAL MEASUREMENT SYSTEM FOR RADIOMETRY AND PHOTOMETRY Final Report
Henry J. Kostkowski Nov. 1977 33 p refs
(PB-274643/6; NBSIR-75-939) Avail: NTIS HC A03/MF A01 CSCL 14B

The National Measurement System Study is concerned with the measurement of the energy or power in ultraviolet, visible and infrared radiation. This study has shown that radiometry and photometry are having a significant economic and social impact in the U.S. today and this impact is expected to increase. NBS' program is designed to improve the situation by (1) making the measurements easier through simpler, inexpensive standards and techniques and (2) increasing the expertise through a Self-Study Manual on the subject. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N78-18257 Princeton Univ., N. J.
SPACE-TIME EVOLUTION OF NONLINEAR THREE-WAVE INTERACTIONS Ph.D. Thesis
Allan Harold Reiman 1977 255 p
Avail: Univ. Microfilms Order No. 77-28132

The space-time evolution is described in one dimension of the lowest order nonlinear interaction of three undamped wave packets. Dephasing effects due to inhomogeneity of the medium are included. An equivalent class of steady-state interactions in two dimensions is also described. The nonlinear saturation by pump depletion of instabilities which are absolute in the pump frame is found to involve only soliton transfer, thus allowing a complete solution in terms of an n-soliton formula. Energy transfer in both absolute and convective decay interactions in an inhomogeneous medium is found to plateau and then decrease with increasing pump width, in striking contrast to homogeneous interactions. The conclusions of the nonlinear analysis are applied to give a description of several nonlinear interactions of current interest in plasma physics. Depletion of a lower hybrid wave by decay to two other lower hybrid waves is calculated, and its possible effect on proposed schemes for radio frequency heating discussed. Dissert. Abstr.

N78-18258 Catholic Univ. of America, Washington, D. C.
A THEORETICAL INVESTIGATION OF SPREAD SPECTRUM MODULATION CONCEPTS AND PERFORMANCE Ph.D. Thesis
Per Axel Kullstam 1977 162 p
Avail: Univ. Microfilms Order No. 77-27786

An important application of spread spectrum modulation is to achieve interference immune communications. Generally, communications system analysis presupposes a defined interference environment, often in statistical terms. However, this viewpoint is not satisfactory in most applications since spread spectrum modulation is used when the interference environment lacks a known characterization. A procedure was developed to eliminate from the performance analysis, artificial or otherwise, restricting assumptions placed on the interference signal or process. By introducing the concept of pseudo-random spreading waveform modulation, it is possible to free the statistical performance analysis from assumptions about the interference process. Dissert. Abstr.

N78-18259*# Axiomatix, Marina del Rey, Calif.
IUS/PAYLOAD COMMUNICATION SYSTEM SIMULATOR CONFIGURATION DEFINITION STUDY Final Report
Sergei Udalov and James C. Springett 18 Jan. 1978 192 p refs
(Contract NAS9-15409)
(NASA-CR-151620; R7801-3) Avail: NTIS HC A09/MF A01 CSCL 17B

The requirements and specifications for a general purpose payload communications system simulator to be used to emulate those communications system portions of NASA and DOD payloads/spacecraft that will in the future be carried into earth orbit by the shuttle are discussed. For the purpose of on-orbit checkout, the shuttle is required to communicate with the payloads while they are physically located within the shuttle bay (attached) and within a range of 20 miles from the shuttle after they have been deployed (detached). Many of the payloads are also under development (and many have yet to be defined), actual payload communication hardware will not be available within the time

frame during which the avionic hardware tests will be conducted. Thus, a flexible payload communication system simulator is required. Author

N78-18260# National Aviation Facilities Experimental Center, Atlantic City, N. J.
TEST AND EVALUATION OF THE MOVING TARGET DETECTOR (MTD) RADAR Final Report, Oct. 1974 - Oct. 1976
Ronald S. Bassford, William Goodchild, and Alfred DeLaMarche Oct. 1977 126 p refs
(FAA Proj. 022-243-510)
(AD-A04788; FAA-RD-77-18; FAA-NA-77-29) Avail: NTIS HC A07/MF A01 CSCL 17/9

The moving target detector (MTD) terminal radar processor system was evaluated to determine its capability to provide radar data suitable for utilization by the Automated Radar Terminal System. The testing was to compare the target detection in clutter performance of the MTD system with that of the best terminal radar processor system in the FAA inventory. The comparative tests were conducted using test signals and flight test aircraft. The test signals were used to determine false alarm rates, probability of detection, accuracy, velocity response, and subclutter visibility capabilities. Flight testing was performed to determine subclutter visibility, subweather visibility, and target resolution capabilities. The results of the tests demonstrated that the MTD system capability to detect targets in a clutter environment was much better than that of present FAA systems. It effectively eliminated all clutter experienced in the National Aviation Facilities Experimental Center radar environment. Author

N78-18261*# Teledyne Brown Engineering, Huntsville, Ala.
SURVEY: AUTOMATED FIELD OPERATIONS AND SERVICES (AFOS)
Nov. 1977 36 p
(Contract NAS8-32539)
(NASA-CR-150548; SD77-MSFC-2150) Avail: NTIS HC A03/MF A01 CSCL 17B

The National Weather Service (NWS) is currently implementing a program for improving operations through automation of routine functions, improved communications capability, and improved management and presentation of data. The program, designated as Automation of Field Operations and Services (AFOS), uses high-speed data circuits, minicomputers, and dynamic display devices to rapidly collect, disseminate, and present data to forecasters and users on both a broadcast and a request basis. The initial system will be configured to serve facilities within the continental United States, Alaska, Hawaii, and Puerto Rico, with eventual expansion to provide international capability. This report discusses AFOS users, functions, and network and site configurations. The sections discuss current and future capability and workload in terms of the 10 data systems elements designated by NASA. Author

N78-18262*# Teledyne Brown Engineering, Huntsville, Ala.
SURVEY: FEDERAL AVIATION ADMINISTRATION NATIONAL COMMUNICATION CENTER
Oct. 1977 31 p
(Contract NAS8-32539)
(NASA-CR-150552; SD-77-MSFC-2149) Avail: NTIS HC A03/MF A01 CSCL 17B

The National Communication (NATCOM) Center (commonly known as the FAA Weather Message Switching Center) is a Federal Aviation Administration (FAA) facility with responsibility for providing communication switching services to the National Weather Service (NWS), the FAA, commercial and private flight organizations under the auspices of the FAA, and DoD. Data handled by NATCOM include weather data, flight plans, and Notices to Airmen (NOTAMS) on both national and international networks. The communications and data management functions are handled through four computer-controlled communication networks designated as WMSC, AFTN, A-BDIS, and NASNET. The functions of these networks are discussed with emphasis on those networks that support the different elements of the NWS. The primary network of concern to NASA, the WMSC (Weather Message Switching Center) network, performs approximately 60 percent of its work for the NWS, 20 percent for the State Department, and 20 percent for the FAA. This document discusses the current and future systems capabilities and workload of NATCOM in terms of new roles. Author

N78-18263*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DESIGN OF MICROSTRIP DISK ANTENNA ARRAYS
M. C. Bailey and F. G. Parks (Kansas Univ., Lawrence) Feb. 1978 82 p refs
(NASA-TM-78631; L-11926) Avail: NTIS HC A05/MF A01 CSCL 17B

The radio frequency characteristics and design parameters for microstrip disk antenna elements and planar arrays are presented. Two C-band model arrays (an 8 element linear and an 8 by 8 planar) were designed, fabricated, and tested to demonstrate the technique of using microstrip elements for array applications. These arrays were designed with a cosine amplitude distribution. Author

N78-18264# Institute for Telecommunication Sciences, Boulder, Colo.
OBJECTIVE MEASUREMENT OF VOICE CHANNEL INTELLIGIBILITY Final Report
K. J. Gamauf and W. J. Hartman Oct. 1977 76 p refs Sponsored in part by Army
(Contract DOT-FA74WAI-448)
(AD-A048611; FAA-RD-77-153) Avail: NTIS HC A05/MF A01 CSCL 17/2

Following the results of a feasibility study an objective intelligibility measure is developed using a large data base consisting of 8-50 word phonetically balanced word groups with twelve different kinds of distortion. Justification for the use of this particluar measure is included, with mathematical derivations and physical interpretations. A discussion of the feasibility of a hardware implementation of the software developed here is also included. Author

N78-18265*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
C-BAND RADAR PULSE DOPPLER ERROR: ITS DISCOVERY, MODELING, AND ELIMINATION
W. B. Krabill and D. J. Dempsey (RCA Corp., Moorestown, N. J.) Feb. 1978 56 p refs
(Contract NAS6-2637)
(NASA-TM-69366) Avail: NTIS HC A04/MF A01 CSCL 17I

The discovery of a C Band radar pulse Doppler error is discussed and use of the GEOS 3 satellite's coherent transponder to isolate the error source is described. An analysis of the pulse Doppler tracking loop is presented and a mathematical model for the error was developed. Error correction techniques were developed and are described including implementation details. Author

N78-18266*# National Aeronautics and Space Administration. Pasadena Office, Calif.
CLUTTER FREE SYNTHETIC APERTURE RADAR CORRELATOR Patent Application
Atul Jain, inventor (to NASA) (JPL) Filed 8 Dec. 1977 8 p
(Contract NAS7-100)
(NASA-Case-NPO-14035-1; US-Patent-Appl-SN-858767) Avail: NTIS HC A02/MF A01 CSCL 17I

A synthetic aperture radar correlation system including a moving diffuser located at the image plane of a radar processor is presented. The output of the moving diffuser is supplied to a lens whose impulse response is at least as wide as that of the overall processing system. A significant reduction in clutter results. The novelty of the invention appears to reside in locating a moving diffuser at the imaging plane of the radar processor and reimaging the diffuser with a lens whose impulse response is at least as wide as the impulse response of the radar system. NASA

N78-18267# Naval Ocean Systems Center, San Diego, Calif.
APPLICATION OF A ROOT FINDING METHOD FOR TROPOSPHERIC DUCTING PRODUCED BY TRILINEAR REFRACTIVITY PROFILES Technical Report, 30 Sep. 1976 - 30 Sep. 1977
C. L. Goodhart and R. A. Pappert 2 Sep. 1977 54 p refs

(RR0210101)
(AD-A047916; NOSC-TR-153) Avail: NTIS HC A04/MF A01 CSCL 17/2

Knowledge of whether or not all modes of consequence have been found is of paramount importance in numerical waveguide studies. A general root finding method (RFM), developed for VLF/LF propagation in the earth-ionosphere waveguide, locates all complex zeros in physically important rectangular regions of the complex plane. The method, based on phase contour tracing, is applied to the problem of tropospheric ducting in a trilinear refractivity environment. Frequencies from VHF and into the microwave range are considered. Principles upon which the RFM is founded are reviewed and modifications of the modal equation demanded by the methods are discussed. Particularly in the microwave range, overflow can be a problem and methods of overcoming this are discussed. However, the RFM is most easily implemented if the latter modifications can be avoided. Therefore, tables are included to indicate for trilinear profiles the maximum frequency below which no overflow problems would occur. These tables depend upon the maximum number which the computer can handle, the location of the search rectangle, and the refractivity profile parameters. In the present case study of ducting produced by a strong elevated layer (40 M unit deficit at about 200 m) the RFM has been applied successfully into S band with computer run time requirements comparable to those of the more conventional Newton-Raphson method. Author (GRA)

N78-18268# Army Electronics Command, Fort Monmouth, N. J.
PREDICTION OF TRANSIONOSPHERIC SIGNAL TIME DELAYS USING CORRELATIVE TECHNIQUES Final Report
H. Soicher Dec. 1977 12 p
(AD-A047917; ECOM-4551) Avail: NTIS HC A02/MF A01 CSCL 20/14

Excess time delays of transionospheric radio signals introduce ranging errors in satellite-navigation and radar systems, which are directly proportional to the total electron content (tec) along the propagation path. Correlations of TEC values (based on linear regression analysis) at Fort Monmouth, N.J. (40.18 deg. N, 74.06 deg. W) Richmond, Fl. (25.60 deg. N, 80.40 deg. W) were previously determined. The correlation analysis was performed at monthly and daily intervals for winter periods during the quiet phase of the solar cycle. GRA

N78-18269# Hughes Aircraft Co., Culver City, Calif. Display Systems and Human Factors Dept.
SYNTHETIC APERTURE RADAR IMAGE PROCESSING TECHNIQUES DEVELOPMENT AND EVALUATION Final Technical Report, Mar. 1976 - Feb. 1977
E. J. Dragavon, M. L. Hershberger, and P. J. Whitt Oct. 1977 147 p refs
(Contract F33615-76-C-1115)
(AD-A048193; HAC-P77-189; HAC-REF-D5676; AFAL-TR-77-113) Avail: NTIS HC A07/MF A01 CSCL 17/9

Synthetic aperture radar (SAR) has a dynamic range much greater than displays used to present the radar ground map video to human observers. This study program was undertaken to explore techniques by which the information contained within the large SAR dynamic range could be presented to human observers. In the pursuit of this goal, monochromatic adaptive gray shade transform, pseudocolor encoding, and feature analytic techniques were examined. Although some of the monochromatic and pseudocolor techniques resulted in improved quality of SAR video images, the improvement was judged insufficient to justify implementation of such techniques in real- or near-real-time SAR systems. Feature analytic techniques used as automatic search, detection, and cueing aids to human observers showed considerable promise, and further work was recommended in this area. Author (GRA)

N78-18270# White Sands Missile Range, N.Mex. Instrumentation Directorate.
SEGMENTATION AND STRUCTURE ANALYSIS FOR REAL-TIME VIDEO TARGET TRACKING Final Report, May - Aug. 1977
K. Fukunaga, A. L. Gilbert, M. K. Giles, O. R. Mitchell, and R. D. Short Oct. 1977 285 p refs
(AD-A048156; STEWS-ID-77-1) Avail: NTIS HC A13/MF A01 CSCL 17/8

Processing techniques for image segmentation and structure analysis were investigated at White Sands Missile Range (WSMR) during the period May through August 1977. An image processing facility was established at WSMR and used to develop and evaluate image processing algorithms for implementation in future real-time video tracker/processor systems. A simulation of a Real-Time Video Tracker, developed under contract by New Mexico State University, was also implemented at WSMR's image processing laboratory, and a library of 20 digitized tracking images was created. Additional tracking imagery, including sequential video frames, is now being added to the digitized image library which will be used to test and evaluate real-time processing algorithms. Detailed descriptions of the systems hardware and software used in the image processing laboratory are presented along with the segmentation and structure analysis algorithms and the results obtained by processing a few of the digitized images. Author (GRA)

N78-18271# CNR, Inc., Needham, Mass.
MULTIPATH OVER LOS CHANNELS STUDY Final Technical Report, Aug. 1976 - Jul. 1977
P. A. Bello, L. Pickering, and C. Boardman Griffiss AFB, N. Y. RADC Nov. 1977 256 p refs
(Contract F30602-76-C-0419)
(AD-A048175; RADC-TR-77-355) Avail: NTIS HC A12/MF A01 CSCL 17/2

A major source of propagation outages on microwave LOS links is multipath fading caused by steep negative refractive index gradients. The advent of highspeed digital transmission over the DCS microwave LOS links brings into concern the possible degrading effects of frequency-selective fading associated with such multipath. The present study extends previous results by CNR on channel modeling for multipath fading on LOS links and the consequent degrading effect of such distortion on digital modems and diversity combining. Two 2 bits/sec/Hz modems were examined. One technique used a baseband modem utilizing the conventional radio with a frequency modulator and frequency discriminator in the receiver. The other technique used an IF modem and involved coherent receiver processing. While the theory developed is applicable to all the DCS links, two particularly difficult links were singled out for study: the Hohenstadt-Zugspitze link in Germany and the Swingate-Houtem link across the English Channel. Considerable SNR degradation was found to be possible for some propagation conditions. In addition, it is shown that conventional diversity switching can produce loss of bit count integrity, but a modified diversity switching plan can alleviate this problem. Author (GRA)

N78-18272# R and D Associates, Marina Del Rey, Calif.
AIRCRAFT RESPONSE EFFECT ON E-FIELD MEASUREMENTS
Gerard Schlegel 9 Mar. 1977 82 p refs
(Contract DNA001-77-C-0012)
(AD-A047986; AD-E300042; RDA-TR-140801-008; DNA-4279T) Avail: NTIS HC A05/MF A01 CSCL 20/3

This report describes the effect of the aircraft response on the measurement of E-fields. In investigating this effect, the effective height data developed by the Boeing Corporation for a l-m blade antenna on a C-130 aircraft was utilized. Difficulties in using this data are discussed, and calculated phase functions to correspond to the amplitude data are presented. Calculated antenna open circuit voltages are then presented for different free field variations and polarizations. Author (GRA)

N78-18273# Army Electronics Command, Fort Monmouth, N. J. Communications/ADP Lab.
LOW PROFILE ANTENNA PERFORMANCE STUDY. PART 3: BIBLIOGRAPHY Final Report, Sep. 1975 - Mar. 1977
C. M. DeSantis Nov. 1977 13 p
(AD-A047991; ECOM-4547-Pt-3) Avail: NTIS HC A02/MF A01 CSCL 09/5

This report contains an extensive bibliography of information on the analysis, design, and experimentation of small antennas aimed at improving bandwidth and efficiency. The report also

contains a tabular summary of the bandwidth of various small antennas which have been reported in the literature. This report forms the third part of a three part series of reports entitled, 'Low-Profile Antenna Performance Study.' Author (GRA)

N78-18274# Army Electronics Command, Fort Monmouth, N. J. Communications/ADP Lab.

LOW PROFILE ANTENNA PERFORMANCE STUDY. PART 2: BROADBAND ANTENNA TECHNIQUES SURVEY Final Report, Sep. 1975 - Mar. 1977

C. M. DeSantis Oct. 1977 43 p refs
(DA Proj. 1T1-61101-A-91A)
(AD-A047992; ECOM-4542-Pt-2) Avail: NTIS HC A03/MF A01 CSCL 09/5

This report is Part II of a three part series of reports investigating small antennas, their bandwidth and efficiency capabilities. Reviews and brief outlines of techniques published in the literature over the past 10-20 years, for broadbanding antennas are provided in this report. Experimental results from measurements of the Goubau antenna, a low-profile antenna (=0.05 lambda at the lowest operating frequency) are presented to show that this antenna possesses an octave bandwidth, regarding both impedance and radiation characteristics. Numerical results for some top-loaded structures are presented and matching network element variations are determined in order to estimate the bandwidth. It is shown that approximately 2:1 and approximately 4:1 increases in bandwidth are achieved when top-loading is applied to the stub and the loop antenna, respectively, and an L-network is used for tuning and matching. It is concluded that there may be several small but broadband antenna configurations possible from a clever (but as yet unknown) combination of the ideas and techniques presented in this report. Author (GRA)

N78-18275*# Stanford Univ., Calif. Electronics Labs.

INTERACTION OF ELECTROMAGNETIC AND ACOUSTIC WAVES IN A STOCHASTIC ATMOSPHERE Final Report

Nirdosh Bhatnagar Jul. 1977 131 p refs
(Grant NGL-05-020-014; Contract N00014-75-C-0601)
(NASA-CR-155746; AD-A047953; SU-SEL-77-031) Avail: NTIS HC A07/MF A01 CSCL 20/3

In the Stanford Radio Acoustic Sounding System (RASS), an electromagnetic signal is made to scatter from a moving acoustic pulse train. Under a Bragg-scatter condition, maximum electromagnetic scattering occurs. The scattered radio signal contains temperature and wind information as a function of the acoustic pulse position. In this investigation, RASS performance is assessed in a real atmosphere where coherency of the acoustic pulse is degraded as it propagates vertically into the lower atmosphere. The only assumption made is that the electromagnetic wave is not affected by stochastic perturbations in the atmosphere. It is concluded that, for acoustic pulses with carrier frequencies below a few kilohertz propagating under typical atmospheric conditions, turbulence has little effect on the strength of the received radio signal at heights up to a few kilometers. This result implies that focusing of RF energy by the acoustic wavefronts is primarily a function of sound intensity which decreases as 1/x-squared, where x denotes altitude. GRA

N78-18276# Harry Diamond Labs., Adelphi, Md.

PROCESSING EMP-RELATED FLASH X-RAY TEST DATA WITH THE TRANS2 COMPUTER PROGRAM

John F. W. Dietz Nov. 1977 51 p refs Sponsored by Defense Nuclear Agency
(AD-A048159; HDL-TM-77-30) Avail: NTIS HC A04/MF A01 CSCL 20/8

When parameters, such as coupled currents, magnetic fields, Compton currents, etc., are measured at a flash X-ray facility, the measured voltages which represent these parameters are a function of the frequency response of the measuring system. By using a measured response (transfer) function for the measuring systems along with Fourier analysis, the computer program TRANS2 transforms measured voltages into the desired parameters. Author (GRA)

N78-18277# Office of Telecommunications, Boulder, Colo. Inst. for Telecommunication Sciences.

EHF TRANSFER AND SHIELDING PROPERTIES OF AIR: SUMMARY OF 1974-1977 ACTIVITIES Final Report

H. J. Liebe and G. G. Gimmestad Oct. 1977 33 p refs
(DA MIPR 14-74; DA MIPR 16-75; DA MIPR 20-76)
(AD-A048067; OT/ITS-910; OT-TM-77-242; ARO-12233.8-GS) Avail: NTIS HC A03/MF A01 CSCL 04/1

The microwave spectrum of oxygen (O2 -MS) was investigated with a pressure-scanning dual-resonator spectrometer between 53 and 64 GHz and with a nonresonant cavity spectrometer at 119 GHz under simulated atmospheric conditions. This summary is intended as a wrap-up and guide to the various outputs covering three main topics: new spectroscopic measurement technique; extensive O2 -MS laboratory studies; and engineering formulation and modeling of clear air (molecular) EHF radio path transfer properties. Author (GRA)

N78-18278# Naval Underwater Systems Center, New London, Conn.

SEA NYMPH PILOT LCC MODEL DEVELOPMENT

Howard E. Knust and John B. Anderson 15 Sep. 1977 44 p refs
(AD-A048109; NUSC-TD-5699) Avail: NTIS HC A03/MF A01 CSCL 17/9

Effective cost management of the Sea Nymph Project requires a dynamic means to (1) identify, (2) define, (3) estimate, (4) calculate, (5) record, (6) evaluate, (7) control, and (8) update cost data. Such data must be processed automatically because of the large number of cost categories (and the factors they consist of) and the necessity to accurately evaluate their effects during project management decision making. Upon assessment of available and feasible cost information, it has been determined by the Naval Electronics Systems Command Headquarters (NAVELEX) PME 107-1 that the most suitable automatic data processing alternative is the life cycle cost (LCC) method and computer resources. These were developed for the Chief of Naval Material (CNM) by the Naval Weapons Engineering Support Activity (NAVWPNENGSUPPACT). A description of the basic method to be used is contained in Life Cycle Cost Guide for Equipment Analysis, January 1977, prepared for the Naval Material Command by NAVWPNENGSUPPACT, Management Engineering Department, Cost Management Division. This report documents LCC application to the Sea Nymph Project and explains practical problems that must be addressed in a typical LCC application. Author (GRA)

N78-18279# Ohio State Univ., Columbus. ElectroScience Lab.

PATTERN PREDICTION OF WIRE ANTENNAS ON SATELLITE STRUCTURES Final Report, 1 Oct. 1976 - 1 Jan. 1978

G. A. Thiele Jan. 1978 10 p refs
(Contract N00173-76-C-0395)
(AD-A048654; ESL-784575-1) Avail: NTIS HC A02/MF A01 CSCL 09/5

A technique which combines the Method of Moments and the Geometrical Theory of Diffraction into a single Hybrid Technique is incorporated into a computer program for determining the performance of wire-type antennas on a planar satellite panel which is joined to other planar panels on each of its sides. The computer program, which is still undergoing revisions, is capable of handling up to five antennas on a single satellite metallic panel. Author (GRA)

N78-18280# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.

IMPROVED QUANTUM RECEIVERS FOR OPTICAL COMMUNICATION Final Report, 1 Jan. 1976 - 30 Jun. 1977

Robert S. Kennedy and Horace P. Yuen 30 Jun. 1977 83 p refs
(Contract N00014-76-C-0605)
(AD-A048688) Avail: NTIS HC A05/MF A01 CSCL 17/2

The main topic of this contract is on the communication theoretic aspects of TCS (Two-photon coherent states) systems. The optimality of TCS has been shown as transmitter quantum states, in a number of linear modulation and binary detection problems. A theory of quantum field propagation has also been developed which is essential for a correct analysis of TCS behavior in optical transmission systems. In particular, the difference

between near-field and far-field TCS communication is now understood. GRA

N78-18281# Naval Ocean Systems Center, San Diego, Calif.
PROGRAMMABLE DATA TERMINAL SET (PDTS) UHF TEST WITH AN/WSC-3 RADIO. OPERATIONAL CAPABILITY OF PDTS IS DEMONSTRATED Technical Report, May - Jul. 1977
G. P. Francis and W. O. Smith 17 Aug. 1977 29 p
(AD-A048295; NOSC-TR-142) Avail: NTIS HC A03/MF A01 CSCL 17/2

FM Link 11 radio circuits in the range from 225 to 300 MHz were used to demonstrate the practicality of the PDTS. High frequencies were used as order-wire circuits. The PDTS was shown to be compatible with the AN/WSC-3 UHF-FM radio (as modified for Link 11 usage) and the AN/WSC-3 performed well in the UHF-FM mode. Author (GRA)

N78-18282# SRI International Corp., Menlo Park, Calif.
WIDEBAND SATELLITE OBSERVATIONS Final Report, 26 May 1976 - 31 May 1977
C. L. Rino, E. J. Fremouw, R. C. Livingston, M. D. Cousins, and B. C. Fair Junt. 1977 90 p refs
(Contract DNA001-75-C-0111)
(AD-A048801; AD-E300071; DNA-4399F) Avail: NTIS HC A05/MF A01 CSCL 17/2

The Wideband Satellite (P76-5) was launched on 22 May 1976 and data have been recorded at three receiving stations since that time. The unique nature of the Wideband signals (coherent transmissions covering VHF to S-band) and the geophysically interesting locations of the receiving stations (covering auroral and equatorial latitudes) have led to a number of new and significant results. These results pertain to both scintillation phenomenology and the physics of striation formulation. This report presents the results of the first year of Wideband operations; work described previously in detailed bimonthly progress reports is only summarized here. Emphasis is placed on aspects not previously described, including: (1) evidence for a geometrical scintillation enhancement due to east-west sheet-like irregularity structures in the auroral zone; (2) spaced-receiver measurements of the diffraction pattern anisotropy and apparent drift motion; (3) total electron content measurements of the paleward boundary of the ionospheric trough; (4) characteristics of equatorial scintillations, particularly the gigahertz scintillation that develop during extremely active periods; and (5) results from the equatorial scintillation campaign conducted in Peru during March 1977. Using the Wideband data base with theoretical work and systems analysis, it should be possible to develop a self-consistent model relating a simple parameterization of the irregularity structure and strength to the observed phase and amplitude scintillations. GRA

N78-18283# Computer Sciences Corp., San Diego, Calif.
SIMULATION CODE FOR UNDERWATER TELEVISION SYSTEMS (SCOUTS) Research and Development Report, 1 Jun. 1976 - 1 May 1977
Alan Gordon and Thomas Selden Sep. 1977 44 p
(Contract N00123-74-C-0312)
(AD-A048769; NOSC-TR-146) Avail: NTIS HC A03/MF A01 CSCL 17/2

Based on the system performance equations developed in the Naval Undersea Center's NUC TP 303, Handbook of Underwater Imaging System Design, a computer code was written to predict the performance of underwater television systems. This code, known as SCOUTS(for Simulation Code for Underwater Television Systems) is written in FORTRAN IV and is suitable for demand or batch runs. SCOUTS allows the user to select environmental, geometric and hardware parameters. It can be used for system design as well as analysis. SCOUTS includes a parametric mode which allows automatic variation of multiple parameters. A complete source listing is included as an Appendix. Author (GRA)

N78-18284# Radar Evaluation Squadron (4754th), Hill AFB, Utah.
SPECIAL EVALUATION FOR PEDESTAL-LEVEL STABILITY OF HEIGHT-FINDER RADARS ON TEMPERATE TOWERS
Bud M. Compton Feb. 1977 26 p
(AD-A048604) Avail: NTIS HC A03/MF A01 CSCL 17/9

Pedestal-level stability of the AN/FPS-6 family hight finder radars in ADCOM was investigated from September 1974 to February 1977 in connection with routine evaluation projects. The investigation was motivated by instability problems encountered at Z-96, Almaden AFS, California, during a routine height finder evaluation project, and the data collected by the evaluation team were used in the investigation. Those data led the evaluation team to correctly conclude that solar heating was associated with the problem. During a 1974-77 investigation, pedestal-level instability problems were encountered only with temperate towers, which have exposed legs. Deviations of the pedestal plane exhibited a diurnal pattern that was strongly correlated with the sun, except at one site, Klamath, California. The information from Klamath was obtained separately from this study and is inconclusive. A plausible explanation for all the findings (neglecting Klamath) is that the tower legs are unequally exposed to the sun so that the unshaded legs expand more than the others, thereby shifting the antenna pedestal. This explanation fits well with the observations whereby deviations were greatest when the sun was high in the sky on clear, calm days, and excursions approached an angular value of 1 mil.GRA

N78-18285# Systems Science and Software, La Jolla, Calif.
A THEORY FOR LONGITUDINAL WAVE PROPAGATION IN A COMPOSITE ROD: A MODEL FOR LINEAR ELASTODYNAMIC BEHAVIOR OF COMPOSITE PENETRATORS Quarterly Progress Report, 1 Jul. - 30 Sep. 1977
Akhilesh Maewal Oct. 1977 27 hp refs
(Contract N00014-77-C-0468)
(AD-A048552; SSS-R-78-3401) Avail: NTIS HC A03/MF A01 CSCL 20/13

A mathematical model is presented for prediction of linear elastodynamic response of metal matrix composite penetrators. Although it is recognized that for the applications envisaged, the anelastic effects are the dominant ones, a study of linear elastic behavior is of importance inasmuch as it yields information about the composite properties required for simulation, using, for example, the HELP code where material strength is not neglected. GRA

N78-18286# Naval Underwater Systems Center, New London, Conn.
NUMERICAL RESULTS FOR MODIFIED IMAGE THEORY QUASI-STATIC RANGE SUBSURFACE-TO-SUBSURFACE AND SUBSURFACE-TO-AIR PROPAGATION EQUATIONS
Peter R. Bannister and Rene L. Dube 7 Dec. 1977 37 p refs
(AD-A048345; NUSC-TR-5775) Avail: NTIS HC A03/MF A01 CSCL 20/14

Numerical results are presented for the previously derived horizontal electric dipole modified image-theory quasi-static range field component approximations. Both subsurface-to-subsurface and subsurface-to-air propagation cases are considered. It is shown that the modified image theory approximations are in good agreement with the more exact numerical integration results. Author (GRA)

N78-18287# National Bureau of Standards, Boulder, Colo. Electromagnetics Div.
NEAR-FIELD ANTENNA MEASUREMENTS ON A CYLINDRICAL SURFACE: A SOURCE SCATTERING-MATRIX FORMULATION
Arthur D. Yaghjian Sep. 1977 42 p refs
(PB-274938/0; NBS-TN-696-Rev) Avail: NTIS HC A03/MF A01 CSCL 09E

The basic transmission formula was derived without recourse to reciprocity, and from a common center approach which separated as an isolated problem the probe characterization and transformation. Both an experimental technique and an approximate analytical technique were presented to determine the required transformed probe coefficients without the use of addition theorems. The approximate technique yielded the probe coefficients directly in terms of the far field of the probe. Computer inversion of the transmission formula was accomplished accurately and efficiently with the aid of the sampling theorem and fast fourier transform algorithm. Author

N78-18288# Harry Diamond Labs., Adelphi, Md.
MEASUREMENT OF THE IMPULSE RESPONSE OF COMMUNICATION ANTENNAS
Daniel H. Schaubert Nov. 1977 47 p refs
(AD-A048070; HDL-TR-1832) Avail: NTIS HC A03/MF A01 CSCL 09/5

A technique for measuring the transient response of UHF and VHF communication antennas is described. The procedure permits accurate determination of the impulse response of linear, time invariant antennas over the bandwidth of concern for high-altitude EMP. The experimental procedure is easy and inexpensive to implement and is suitable for laboratory and field testing. A key part of the experimental equipment is the transverse electromagnetic (TEM) horn antenna, which permits illumination of the test antenna with a single short pulse of energy. Special balanced configurations of the TEM horn have been developed to provide optimum radiation characteristics without the need for a conducting ground plane. A wire-grid model was developed for field testing and transportable applications. Measured transient responses of several antennas are presented. Data processing techniques for obtaining the impulse response from measured data are presented along with a comparison of predicted and measured response to a simulator. Author (GRA)

N78-18289# National Aerospace Lab., Amsterdam (Netherlands). Scientific Services.
DETERMINATION OF ANTENNA RADIATION PATTERNS, RADAR CROSS SECTIONS AND JAM-TO-SIGNAL RATIOS BY FLIGHT TESTS
O. B. M. Pietersen, G. J. Alders, and R. B. A. Wasch 14 Sep. 1976 13 p Presented at the Symp. on Flight Test Tech. of the AGARD Flight Mech. Panel, Porz-Wahn, West Ger., 11-14 Oct. 1976
(NLR-MP-76023-U) Avail: NTIS HC A02/MF A01

A flight test data acquisition and processing method, aimed at the determination of radiation patterns of airborne equipment is discussed. The data acquisition procedure, and the data processing and presentation schemes used, are discussed. ESA

N78-18290# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Flugfunk und Mikrowellen.
THE GEOMETRICAL THEORY OF DIFFRACTION - A METHOD FOR THE SOLUTION OF ELECTROMAGNETIC BOUNDARY VALUE PROBLEMS OF COMPLICATED STRUCTURES IN THE HIGH FREQUENCY CASE
A. Schrott [1977] 250 p refs In GERMAN; ENGLISH summary
Report will also be announced as translation (ESA-TT-435)
Avail: NTIS HC A11/MF A01

Determination of the radiation characteristic of antennas on complicated structures, such as satellites and aircraft, and the scattering at these structures in the high frequency case with the aid of the geometrical theory of diffraction is dealt with. The complicated structures are divided into canonical forms, which can be analyzed by rigorous asymptotic methods. The most important canonical problems like the diffraction at an edge are treated extensively. The diffraction coefficients for the computation of the diffracted field are presented. Ray tracing is carried out for several structures. The computation of the field at caustics with the aid of equivalent edge currents or correction factors respectively is discussed in detail. The field of application and the accuracy of the geometrical theory of diffraction is demonstrated with numerous computational examples. Author (ESA)

N78-18291# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Flugfunk und Mikrowellen.
THE INTEGRAL EQUATION METHOD - A COMPUTATIONAL METHOD FOR DIFFRACTED AND SCATTERED FIELDS OF COMPLICATED STRUCTURES
V. Stein [1977] 214 p refs In GERMAN; ENGLISH summary
Report will also be announced as translation (ESA-TT-436)
Avail: NTIS HC A10/MF A01

Determination of the radiation and scattering behavior of complicated structures with the aid of the integral equation method is dealt with. These structures may be complicated isolated radiators or shapes like helicopters or satellites, which are excited by an electromagnetic wave. The real structure is substituted by a mathematical model for the solution of the electric and magnetic field integral equations by means of the method of moments. In order to reduce the computer storage requirements special procedures such as the numerical Green function are used. The combination of both integral equations for the investigation of special problems like the resonance case is discussed in some detail. The field of application and the accuracy of the integral equation method are demonstrated with numerous computational examples. Author (ESA)

N78-18292# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Flugfunk und Mikrowellen.
THE EFFECTS OF MULTIPATH RECEPTION ON MONOPULSE SYSTEMS [DIE EINFLUESSE DES MEHRWEGEEMPFANGS AUF MONOPULSSYSTEME]
D. Salzer 11 Aug. 1977 53 p refs In GERMAN Sponsored by Deut. Akad. Austauschdienst
(DLR-IB-551-77/7) Avail: NTIS HC A04/MF A01

The effects of reflection on phase- and amplitude monopulse systems are analyzed, and the systems are compared qualitatively. Three types of approaches are used: theoretical behavior in the case of ground reflection; vector analysis; simplified description of the theoretical behavior; and simulation. Phase- and amplitude monopulse systems were simulated on a computer. Several functions describing the systems were plotted so that the systems could be compared. ESA

N78-18293# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
A CLUTTER MAP FOR A PHASED ARRAY RADAR SYSTEM [EINE CLUTTERKARTE FUER ELEKTRONISCH GESTEUERTES RADAR]
W. Fleskes Oct. 1976 54 p refs In GERMAN; ENGLISH summary
(FFM-247) Avail: NTIS HC A04/MF A01

The clutter map described is part of a control and data processing program for a phased array radar system. The map provides the possibility of avoiding false alarms for the entire surveillance area using stored echo information. The map is constructed and updated in real time by an adaptive three-dimensional binary list processing technique. False alarm probabilities are estimated in converging volumina and controlled by a test on uniform distribution. The method allows confining computing time and storage requirements so that real time operation in the fast core memory of a multipurpose computer programmed in FORTRAN is possible. The estimated false alarm probabilities are suitable for a locally dependent system control with regard to clutter, e.g., for searching and track initiation, determination of sampling time, and detection threshold, as well as for protection against overload. Author (ESA)

N78-18294# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
NUMERICAL PROBLEMS IN RESOLVING NEAR-NEIGHBOR TARGETS [NUMERISCHE PROBLEME BEI DER AUFLOESUNG ENG BENACHBARTER ZIELE]
U. Nickel Aug. 1976 42 p refs In GERMAN; ENGLISH summary
(FFM-248) Avail: NTIS HC A03/MF A01

Numerical problems of detection and parameter estimation of multiple targets within one resolution cell are discussed. The influence of the antenna size, element spacing, amplitude, and phase difference of the targets on the quality of parameter estimation is outlined. Various algorithms for the parameter estimation were tested, providing data on the theoretical capacity which could be expected from resolution. Author (ESA)

N78-18295# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
RADAR FIXED ECHO SUPPRESSION BY PREFILTERING AT CONSTANT RADIATION DIRECTION [RADARFESTZEICHENUNTERDRUECKUNG DURCH VORFILTERUNG BEI KONSTANTER ABSTRAHLRICHTUNG]
W. Buehring Mar. 1977 32 p refs In GERMAN; ENGLISH summary
(FFM-257) Avail: NTIS HC A03/MF A01

Radar without continuously rotating antenna and in a

step-scan mode receive a sequence of echoes from each resolution cell. The optimal method for target detection under conditions of ground interference is a test over the total echo sequence, implementing the inverse of the interference covariance matrix. Suboptimal solutions are given in the case of ground clutter and the possibilities of their realization are discussed. The given filter configurations lead to a better target detection in the range of low Doppler shifts compared to conventional MTI solutions.
Author (ESA)

N78-18296# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
EXPERIENCES WITH THE ASSESS 2 LIDAR EXPERIMENT [ERFAHRUNGEN AUS DEM ASSESS 2 LIDAR-EXPERIMENT]
C. Werner, H. Herrmann, and F. Koepp 7 Oct. 1977 75 p In GERMAN Report will also be announced as translation (ESA-TT-458)
(DLR-IB-553-77/6) Avail: NTIS HC A04/MF A01

The lidar experiment on the second ASSESS (Airborne Science Spacelab Experiments System Simulation) flight in May 1977 at Ames Research Center is discussed. Light pulses in the wavelength range of 1.06 micrometer from Nd:glass laser were transmitted vertically downwards and the backscattered radiation from the earth and from atmospheric particles were received on a radiation detector by means of a parabolic mirror. It was found that for a Spacelab mission only experiments can be used that have been tested for a long time onboard an aircraft and that operate nearly completely automatically. ESA

N78-18297# National Physical Lab., Teddington (England). Div. of Computer Science.
SIMULATION OF THE 10-NODE DATA COMMUNICATION NETWORK OPERATING WITH LINK SPEEDS OF 9.6 Kb/s
W. L. Price Jan. 1977 28 p refs Sponsored by Computer Systems and Electron. Requirements Board
(NPL-Com-87) Avail: NTIS HC A03/MF A01

The influence of reducing the line bandwidth from 1.5 Mbits/sec to 9.6 Kbits/sec on network operational parameters was investigated and an attempt to optimize network performance was undertaken. Variation of timeouts in the cases of even and uneven traffic matrices is discussed together with variation of the link period, of sorting doctrine, of queue length and degree of slot reservation for through-traffic. A comparison with GMD simulation experiments was carried out. ESA

N78-18298# European Space Agency, Paris (France).
INTENSITY, ANGULAR DISTRIBUTION AND POLARIZATION OF SPONTANEOUS MOLECULAR LIGHT SCATTERING
Klaus Stursberg Jan. 1978 157 p refs Transl. into ENGLISH of 'Intensitaet, Winkelabhaengigkeit u. Polarisationszustand der spontanen molekularen Streustrahlung', DFVLR, Cologne Report DLR-FB-77-20, 26 May 1977 Original report in GERMAN previously announced as N78-14887 Original German report available from DFVLR, Cologne DM 60.50
(ESA-TT-438; DLR-FB-77-20) Avail: NTIS HC A08/MF A01

Light scattering theories are outlined for single systems such as free atoms and molecules. To a fair approximation the results apply to gases. The effect of molecular interactions within liquid and crystals on the light scattering phenomenon is shown on the basis of empirical data. The generally accepted quantum mechanical and classic theory of the spontaneous molecular light scattering and the spectral theory of Rayleigh and Raman scattering are treated. The scattering cross sections, which characterize the light scattering by single particles, the intensity of light scattered by a large number of molecules, the angular distribution, and the degree of depolarization of the scattered light are given as functions of polarization state of the incident light and the direction of observation. In order to confirm the theoretical statements and to allow a numerical treatment of the given equations the experimental results of light scattering analysis are presented. Since the specific vibration and rotation constants, the degree of depolarization, and the refractive indices are known for many gases, the frequencies, the intensity distribution, the polarization state, and the angular distribution of Rayleigh and Raman scattering can be calculated.
Author (ESA)

N78-18299# Office of Telecommunications, Boulder, Colo. Inst. for Telecommunication Sciences.
COMMUNICATION SYSTEM PERFORMANCE MODEL FOR VHF AND HIGHER FREQUENCIES
R. D. Jennings and S. J. Paulson Oct. 1977 173 p refs Sponsored in part by Army
(PB-274458/9; OTR-77-128) Avail: NTIS HC A08/MF A01 CSCL 17B

Communication system designers and engineers often must decide whether to use design-aid models not well suited to the problem at hand or to perform many tedious and laborious hand calculations which, coupled with certain 'rules of thumb,' provide an estimate of system performance. A model was developed which provides relief from such problems. The model considers terrain influences, along with other commonly considered influences, by automatically accessing digitized topograhic data files to develop the path data needed to compute the basic transmission loss. Computation of the basic transmission loss is accomplished using the Longly-Rice formulation for point to point paths. GRA

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N78-18300 Cornell Univ., Ithaca, N. Y.
SMALL-SIGNAL CHARACTERISTICS OF GALLIUM ARSENIDE SCHOTTKY-READ IMPATT DIODES Ph.D. Thesis
John Joseph Berenz 1977 276 p
Avail: Univ. Microfilms Order No. 77-28190

The diodes were characterized with respect to their static parameters, microwave small signal admittance, and small signal avalanche noise properties. Diode parameters which were obtained from the experimental data were related to the microwave performance of the diodes. The oscillator conversion efficiency of the diodes is observed to increase as the donor spike is moved closer to the metallurgical junction. From a comparison of reachthrough and not-reachthrough diode types it is concluded that the reachthrough structure is well suited to broadband, low phase distortion reflection amplifier application, since it exhibits small values of electronic quality factor over broad bandwidths. The not-reachthrough structure, on the other hand, is better suited to high efficiency oscillator application. A double spike low-high-low doping structure is proposed in order to achieve small electronic reactance without sacrificing conversion efficiency.
Dissert. Abstr.

N78-18301 Mississippi State Univ., State College.
STATE VARIABLE APPROACH TO THE GENERAL THEORY OF ELECTRICAL MACHINES Ph.D. Thesis
Mohamed Fathi Hussain Bara 1977 137 p
Avail: Univ. Microfilms Order No. 77-28534

The general theory basics and equations were given for some typical electrical machines, together with the state equations of the electrical and mechanical parts of the machine in question. The steady state conditions of operation were deduced from the machine equations and the transient analysis was performed by solving the state equations with the machine terminal constraints imposed by the operating conditions. A digital computer program was developed to mechanically solve the state equations of the machine to evaluate the currents and torque. This program was applied to three typical problems of direct current, synchronous and induction machines. The Kron primitive machine model and the stationary direct, quadrature and zero axes frame of reference were used throughout this work. The state variable approach was shown to be an efficient, unified and systematic approach for machine analysis.
Dissert. Abstr.

N78-18302 Florida Univ., Gainesville.
TRANSIENT, DRIFT-DOMINATED, BIPOLAR CONDUCTION

IN DIELECTRICS Ph.D. Thesis
Richard John Sojka 1977 171 p
Avail: Univ. Microfilms Order No. 77-29284

Mathematical analysis and numerical techniques for solving transient, drift-dominated, bipolar conduction problems in dielectrics are presented. Mathematically, this problem is treated by using the method of characteristic to transform the governing partial differential equations into ordinary differential equations in standard form for numerical integration based on the Runge-Kutta technique. Various numerical studies of bipolar injection resulting from a step voltage from rest excitation with Langevin recombination are analyzed in terms of the transient electric field and net charge density distributions. For a stainless steel, parallel-plate, capacitor, the transient, bipolar, electric field and space charge density distributions are measured in nitrobenzene utilizing the Kerr effect. At field strengths of 30 KV/cm a region of immobile, positive charge is formed near the anode while mobile negative ions are injected from the cathode. The mobility of the negative ions exhibit an anomalous behavior 1 millisecond after the field is applied. Dissert. Abstr.

N78-18303 Colorado Univ., Boulder.
COMPUTER SIMULATION OF InP TRANSFERRED-ELECTRON DEVICES DESIGNED FOR Ka-BAND OPERATION Ph.D. Thesis
Robert Michael Raymond 1977 254 p
Avail: Univ. Microfilms Order No. 77-29966

The calculation and comparison of small signal and large signal characteristics for various InP transferred electron devices designed to either amplify or oscillate the Ka band was studied. Three cathode contact devices were compared: (1) the p notch cathode contact device; (2) the step up heterojunction cathode contact device; and (3) the conventional ohmic cathode contact device. A computer program was developed to simulate the electron dynamics in the device. A technique was developed to design a p notch to yield a desired uniform field in the active region of the device. It was found that the p notch of a given width is quite versatile in obtaining a wide range of uniform field values and carrier densities in the active region by controlling the notch doping and device bias. Dissert. Abstr.

N78-18304 Maryland Univ., College Park.
HIGH Q SELECTIVE FILTERS USING MECHANICAL RESONANCE OF SILICON BEAMS Ph.D. Thesis
Marija Franc Hribsek 1976 143 p
Avail: Univ. Microfilms Order No. 77-28730

The method for transfer function calculation for simple and multibeam structures was developed. The silicon beams showed high Q selective characteristics. The method was based on the theory of mechanical vibrations of thin bars and piezoresistive properties of silicon. The lumped equivalent mechanical model of vibrating beam structures was obtained and used for the calculation of both transfer function and resonant frequency. Design procedures were given for simple and double beam high Q filters. It was pointed out that single beam filters can be used as the essential part of an audio oscillator. The study of anisotropic etching of silicon proves that the practical realization of the vibrating silicon beam structures was possible. The construction procedure was developed for both single and double beam filters. Dissert. Abstr.

N78-18305 Maryland Univ., College Park.
SYNTHESIS OF LINEAR PASSIVE TIME-VARIABLE TRANSMISSION MATRICES Ph.D. Thesis
Tri Thuc Ha 1977 139 p
Avail: Univ. Microfilms Order No. 77-29130

Using the closed system approach of Livsic, state space properties of transmission matrices of nondissipative networks were presented. The result was extended to cover finite passive networks. It was shown that the transmission matrix T with its associated coupling channel matrix J of a finite nondissipative network was J quasilossless. The J quasilossless was also derived using a direct energy approach. Using the derived J quasilossless criteria two types of J quasilossless synthesis were devised. The first was a cascade load synthesis for specific J quasilossless transmission matrices. The second synthesis was more general and applies to any J quasilossless transmission matrix and is termed cascade synthesis. The procedure consists of factoring the given J quasilossless transmission matrix of constant degree r into a degree zero and r degree one canonical J quasilossless transmission matrices. Dissert. Abstr.

N78-18306 Georgia Inst. of Tech., Atlanta.
STATISTICAL ESTIMATION THEORY APPLIED TO SYNCHRONOUS GENERATOR MODELING Ph.D. Thesis
Charles William Brice, III 1977 86 p
Avail: Univ. Microfilms Order No. 77-29211

An ideal generator model is reduced to a state-space formulation, and the method of quasilinearization is used to develop an optimal parameter estimation algorithm, implemented on a small digital computer. The experiment to produce data for the parameter estimator is designed with the aid of a computer simulation of the experimental setup. The simulation includes a model of a typical generator with a switched load. The objectives of the design of the experiment are to produce sufficient data to permit the estimator to work well, while recognizing economic constraints on equipment and computer time. The experiment is implemented on a real synchronous generator with data recorded and digitized off-line. A method of estimating the generator model parameters from switched-load test data corrupted by considerable measurement noises is presented. Dissert. Abstr.

N78-18307* National Aeronautics and Space Administration, Washington, D. C.
COMPARATIVE CHARACTERISTICS OF ELECTRON ENERGY SPECTRUM IN PIG AND ARC TYPE DISCHARGE PLASMAS
L. I. Romanyuk and N. Ye. Suavilnyy Feb. 1978 8 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (USSR), v. 21, no. 12, Dec. 1976 p 1978-1982 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc prep. by Academy of Sciences Ukrainian SSR, Kiev
(Contract NASw-2790)
(NASA-TM-75255) Copyright. Avail: Issuing Activity CSCL 09C

The electron distribution functions relative to the velocity component directed along the magnetic field are compared for PIG and arc type discharges. The identity of these functions for the plasma region pierced by the primary electron beam and their difference in the peripheral part of the discharge are shown. It is concluded that the electron distribution function in the PIG type discharge is formed during one transit of the primary electron through the discharge gap. The mechanisms of electron energy spectrum formation in both the axis region and the peripheral region of the discharge are discussed. Author

N78-18308* National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
WINDOW COMPARATOR Patent
James M. Black, inventor (to NASA) Issued 25 Oct. 1977 7 p Filed 2 Nov. 1976 Supersedes N77-11296 (15 - 20, p 0184)
(NASA-Case-FRC-10090-1; US-Patent-4,055,777; US-Patent-Appl-SN-737974; US-Patent-Class-307-360; US-Patent-Class-307-350; US-Patent-Class-307-265; US-Patent-Class-328-150) Avail: US Patent Office CSCL 09A

A window comparator is described, comprising two operational amplifiers, one with two feedback circuits, each feedback circuit having a diode connected to the amplifier output and poled for forward current conduction of opposite polarity, to provide an algebraic difference between an input signal and a selected set-point voltage. Differential input terminals of the second operational amplifier were connected to the separate feedback circuits of the first operational amplifier, one input terminal to the output of one diode, and the other to the output of the other diode. A selected window-width voltage was connected through a coupling resistor to one of the input terminals of the second operational amplifier to determine when the algebraic difference of the input signal and the setpoint voltage has exceeded a predetermined tolerance after that difference has changed signs. Official Gazette of the U.S. Patent Office

N78-18309*# National Aeronautics and Space Administration, Washington, D. C.
COUPLING OF ELECTROMAGNETIC WAVES AND SPACE

CHARGE WAVES IN TYPE O TRAVELING WAVE TUBES
P. Ricci Feb 1978 18 p refs Transl. into ENGLISH from the 12th Convegno Intern. delle Commun. (Genoa), v. 2, Oct. 1964 p 1001-1015 Presented at the 12th Convegno Intern. delle Commun., Genoa, 8-12 Oct. 1964 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-2790)
(NASA-TM-75249) Avail: NTIS HC A02/MF A01 CSCL 09C

H. Derfler observed that a parameter defined by Pierce's perturbation method does not have the same physical significance as an analogous parameter described by a differently derived equation of W. Kleen. A modification of Pierce's method is proposed, which yields an equation of Derfler's type, and also allows quicker and easier calculation of a given traveling wave tube's parameters. Author

N78-18310*# National Aeronautics and Space Administration, Washington, D. C.
PARTIAL DISCHARGES IN THE TRANSFORMERS DUE TO INDUCED VOLTAGES
A. Veverka Feb. 1978 8 p ref Transl. into ENGLISH from Elektrotech Obz. (Czechoslovakia), v. 60, no. 3, Mar. 1971 p 117-119 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-2790)
(NASA-TM-75256) Avail: NTIS HC A02/MF A01 CSCL 09C

The supplement furnishes a theoretical proof containing the experimentally determined advantage for the connection of capacitance C sub 0 between the insulated frame and ground according to the arrangement presented in the article. Author

N78-18311*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
GUIDELINES FOR THE SELECTION AND APPLICATION OF TANTALUM ELECTROLYTIC CAPACITORS IN HIGHLY RELIABLE EQUIPMENT
A. M. Holladay 31 Jan. 1978 68 p Supersedes NASA-TM-X-64755; N73-26200
(NASA-TM-X-64755-Rev-A) Avail: NTIS HC A04/MF A01 CSCL 09A

Guidelines are given for the selection and application of three types of tantalum electrolytic capacitors in current use in the design of electrical and electronic circuits for space flight missions. In addition, the guidelines supplement requirements of existing military specifications used in the procurement of capacitors. A need exists for these guidelines to assist designers in preventing some of the recurring, serious problems experienced with tantalum electrolytic capacitors in the recent past. The three types of capacitors covered by these guidelines are: solid, wet foil, and tantalum cased wet slug. Author

N78-18312*# National Aeronautics and Space Administration, Washington, D. C.
AN RC ACTIVE FILTER DESIGN HANDBOOK Technology Utilization
Gordon J. Deboo (NASA. Ames Res. Center) 1977 181 p refs
(NASA-SP-5104) Avail: NTIS HC A09/MF A01 CSCL 09C

The design of filters is described. Emphasis is placed on simplified procedures that can be used by the reader who has minimum knowledge about circuit design and little acquaintance with filter theory. The handbook has three main parts. The first part is a review of some information that is essential for work with filters. The second part includes design information for specific types of filter circuitry and describes simple procedures for obtaining the component values for a filter that will have a desired set of characteristics. Pertinent information relating to actual performance is given. The third part (appendix) is a review of certain topics in filter theory and is intended to provide some basic understanding of how filters are designed. Author

N78-18313*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MICROWAVE DICHROIC PLATE Patent Application
Thomas E. Wise, inventor (to NASA) (Bendix Corp., Columbia, Md.) Filed 16 Feb. 1978 21 p Sponsored by NASA
(NASA-Case-GSC-12171-1; US-Patent-Appl-SN-878542) Avail: NTIS HC A02/MF A01 CSCL 09C

A dichroic plate for microwave energy which includes an array of interlaced crossed slots or dipole elements was developed. Each of the elements included first and second crossed arms that are at approximately right angles to each other and aligned with X and Y axes. The elements were arranged so that the centers were aligned parallel to the X and Y axes to form columns and rows. The interlacing was such that a line between the centers of all adjacent elements had non zero, differing components relative to the X and Y axes. In one embodiment, the spacing between adjacent arms of different, adjacent elements was the same along the X and Y axes, while in a second embodiment, the spacing between similarly directed arms of adjacent elements differed from the spacing between oppositely directed arms of adjacent elements. NASA

N78-18314# Stanford Univ., Calif. Digital Systems Lab.
AN ALGORITHM FOR TESTING THE PLANARITY OF PARTIALLY ORIENTED GRAPHS
W. M. VanCleemput Jun. 1977 20 p refs
(Contract N00014-75-C-0601)
(AD-A048052; SU-DSL-TN-116) Avail: NTIS HC A02/MF A01 CSCL 09/3

An efficient algorithm will be presented for testing the planarity of oriented and partially oriented graphs. This algorithm is very useful for solving problems related to the circuit layout problem. Author (GRA)

N78-18315# Rockwell International Corp., Richardson, Tex. Microelectronics Div.
A PRODUCTION ENGINEERING MEASURE FOR TWO L-BAND SOLID STATE MICROWAVE FREQUENCY SOURCES Quarterly Report, 28 Feb. - 31 May 1977
L. D. Bachman 31 May 1977 72 p
(Contract DAAB07-76-C-0026)
(AD-A047903; QR-4) Avail: NTIS HC A04/MF A01 CSCL 09/5

This report describes the specifications and approach, details the work completed in the design and fabrication of two L-band solid state frequency sources, and describes the progress made towards an eventual high rate production demonstration of these two circuits. These two circuits are a Modulator/Transmitter for Radiosonde applications and an FM Source. The fourth set of Radiosonde engineering samples has been completed and performance data is available. All effort has been terminated on this portion of the program. Work on the fourth set of FM Source engineering models has been stopped until complete analysis of the second order linearity problem has been made. Analytical analysis is being performed on several network topologies in order to determine the optimum oscillator configuration for best linearity. Author (GRA)

N78-18316# Hughes Aircraft Co., Torrance, Calif.
MODEL 8726H TRAVELING WAVE TUBE Final Technical Report, Jan. 1976 - Jul. 1977
C. A. Ar Nov. 1977 55 p
(Contract F30602-76-C-0105)
(AD-A048222; RADC-TR-77-344) Avail: NTIS HC A04/MF A01 CSCL 09/5

This report describes the development of a coupled cavity traveling wave tube with the following specifications. Gain - 53 db; Pulse Length - 200 microseconds; Modulation - Shadow Grid (less than 700 nanoseconds rise and fall times); Focusing - PPM; Efficiency - 25 percent minimum; Phase Linearity - Plus and minus 10 degrees. Author (GRA)

N78-18317# IRT Corp., San Diego, Calif.
STUDY OF RADIATION-HARDENED QUARTZ PRODUCTION PROCESSES Final Report, 10 Jun. - 31 Dec. 1976
D. P. Snowden, M. J. Treadaway, W. Hardwick, T. F. Wrobel, and T. M. Flanagan 9 Feb. 1977 43 p refs
(Contract F19628-76-C-0266)
(AD-A048264; IRT-8151-003; RADC-TR-77-219) Avail: NTIS HC A03/MF A01 CSCL 09/1

The results of an initial program performed by IRT Corporation in support of the RADC/DNA program 'Radiation Hardened Quartz Process Investigations' are presented. Included are calculated depth-dose profiles in the resonator assuming 10-MeV electrons incident on the oscillator package to be used in the resonator

evaluation program. Also presented are the results of irradiations of the oscillator package at the RADC facility. Effectiveness of a collimator in protecting oscillator and oven control electronics has been assessed and the results of dose mapping throughout the electronics is presented. Scaling relationships relating dose in the resonator to the dose at an external reference point were developed. Irradiations of a working oscillator were performed to assess the extent of possible experimental anomalies that would impact the actual RADC measurements. The results of the above tasks were evaluated in light of their impact on the RADC program and used to formulate working procedural and/or equipment choice suggestions. In addition, a preliminary study has been made of the hardness assurance requirements for quartz used in quarts crystal filters. Author (GRA)

N78-18318# Stanford Univ., Calif. Digital Systems Lab.
ON THE PLANARITY OF HYPERGRAPHS
W. M. VanCleemput Jun. 1977 17 p refs
(Contract N00014-75-C-0601)
(AD-A048051; SU-DSL-TN-115) Avail: NTIS HC A02/MF A01 CSCL 09/3

Two definitions for the planarity of a hypergraph will be given. These definitions are related to the problem of modelling circuits for circuit layout. It is shown that if a hypergraph is planar according to the first definition, then it is planar according to the second definition, but the reverse does not hold. Testing the planarity can be done in linear time by using the first definition but requires an enumeration using the second definition. The more accurate model for the circuit layout problem uses the second definition. Author (GRA)

N78-18319# Norden, Norwalk, Conn.
STANDARD ELECTRONIC MODULE RADAR COST ANALYSIS Final Report, 1 Jun. - 30 Nov. 1976
R. Hoefle, R. Archbald, and R. Lipeles Jul. 1977 111 p refs
(Contract F33615-76-C-1306)
(AD-A048207; Rept-1266-R-0007; AFAL-TR-77-26) Avail: NTIS HC A06/MF A01 CSCL 17/9

The standard electronic module radar (SEMR) is a redesigned AN/APN-59b weather, navigation, beacon radar system using standard electronic modules wherever possible. Two configurations of SEMR have been developed to permit use in C-130 and C-135 or in C-141 aircraft. Both configurations include built-in test equipment (BITE) to provide fault detection and isolation to 4 to 6 modules. Author (GRA)

N78-18320# Westinghouse Defense and Electronic Systems Center, Baltimore, Md. Systems Development Div.
BUILDING BLOCK MODULES: FREQUENCY SYNTHESIZER AND AMPLIFIER-MIXER Final Report, Jun. 1975 - Jun. 1976
E. Kuesters and E. Harrison Oct. 1977 51 p refs
(Contract F33615-75-C-1245)
(AD-A048209; AFAL-TR-76-185) Avail: NTIS HC A04/MF A01 CSCL 09/5

The report covers the design and development of two building block modules for potential application to AFSAT and other CN subsystems. A small dual amplifier mixer for 70 MHz IF with 25 db gain(each) measuring 1.3 in. x 2.05 in. x 0.45 in. is described. A 70 MHz frequency synthesizer was developed which provides 2 to the 24th power frequencies with 0.48 Hz step size and 1 Hz spectral purity of -50 dB within 20 Hz of center frequency. Author (GRA)

N78-18321# Westinghouse Electric Corp., Baltimore, Md.
MODULAR PACKAGING APPROACHES Final Report, 1 Mar. - 30 Sep. 1976
W. W. Staley Jul. 1977 129 p refs
(Contract F33615-75-C-1269)
(AD-A048205; Rept-77-0043; AFAL-TR-76-61-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 09/3

The objective of this study is to investigate the feasibility, practicality, and implementation of standard electronic modules SEM for avionics. Tradeoff studies are used to provide quantitative SEM formats. The broad spectrum of considerations necessary to characterize standard packaging for a wide class of avionics applications are investigated. In depth quantification is placed primarily on digital signal processing and to a lesser degree on analog circuitry. The work is performed in four tasks whereby Task 1 evaluates current and past industry and DOD module programs, Task 2 studies present technology and technological trends for determination of the standard avionics modules, Task 3 is a compilation of industry and DOD data concerning standard module information and concepts, and Task 4 is the detailed development and evaluation of the proposed 'Westinghouse SEM' including the construction of demonstration hardware. The efforts of Tasks 1, 2, and 3 are described in the previous issued interim Report AFAL-TR-76-61, Volume 1. This Final Report describes the details of the study performed on Task 4 with the conclusions made and recommendations for future work. Author (GRA)

N78-18322# Raytheon Co., Bedford, Mass. Missile Systems Div.
HIGH SPEED MICRO SIGNAL PROCESSOR STUDY Final Report, 1 Jun. 1976 - 31 Jan. 1977
Gerald N. Shapiro Wright-Patterson AFB, Ohio AFAL Sep. 1977 217 p refs
(Contract F33615-76-C-1339)
(AD-A047997; AFAL-TR-77-52) Avail: NTIS HC A10/MF A01 CSCL 17/9

This study defines a micro signal processor design based on maximum use of off-the-shelf IC functions, supplemented by special personalization of standard arrays. The signal processor elements can be grouped into Control, Memory and Arithmetic type elements. These elements are stackable into a variety of configurations because of the standardization applied to the data transfer timing. Author

N78-18323# Naval Civil Engineering Lab., Port Hueneme, Calif.
COMPUTER TECHNIQUE FOR CALCULATIONS OF POTENTIAL DISTRIBUTION IN MULTIDIELECTRIC MEDIA Progress Report, Jul. 1974 - Sep. 1976
Kwang Ta Huang, Brian R. Milner, and Andrew W. McClaine Sep. 1977 76 p
(YF5354011)
(AD-A048057; CEL-TN-1502) Avail: NTIS HC A05/MF A01 CSCL 20/3

A finite-difference method computer program for calculating the potential distribution for axisymmetric insulator configurations was developed. The program allows the use of unequal grid spacings and multiple dielectric constants. In addition, methods were developed to determine the potentials of conductors whose potentials are unknown, satisfy unknown grid boundary conditions, calculate electric flux line distributions, and plot the field lines by computer. The program has the flexibility to solve similar types of problems that involve the solution of Laplace's or Poisson's equations. Problems that consist of two-dimensional geometries can be treated by using a variation of the axisymmetric program. Author (GRA)

N78-18324# Science Applications, Inc., Berkeley, Calif.
CALCULATION OF THE PER-UNIT LENGTH CAPACITANCE MATRIX FOR SHIELDED INSULATED WIRES Final Report
Shu-Kong Chang, Tom K. Liu, and Frederick M. Tesche Kirtland AFB, N. Mex. AFWL Sep. 1977 31 p refs
(Contract F29601-76-C-0125)
(AD-A048174; AD-E200039; AFWL-TR-77-89) Avail: NTIS HC A03/MF A01 CSCL 09/1

In this report, the per-unit-length capacitance matrix of a multiconductor transmission line enclosed in a shielding tube is calculated using the method of multiseries expansion. Each individual wire may be dielectric coated. The methods of evaluating the corresponding per-unit-length inductance matrix and the propagation matrix are also presented. Author (GRA)

N78-18325# Naval Surface Weapons Center, White Oak, Md.
THE DENSITY, ELECTRICAL RESISTIVITY AND HALL COEFFICIENT OF Li-B ALLOYS Final Technical Report, 1 Jul. 1972 - 1 Jan. 1977
M. A. Mitchell and R. A. Sutula 23 Sep. 1977 42 p refs
(AD-A048064; NSWC/WOL-TR-77-144) Avail: NTIS HC A03/MF A01 CSCL 11/6

The density, electrical resistivity, and Hall constant of LiB Alloys in the concentration range 0-60 at % B are reported.

An analysis of the measured density of the LiB reveals that in the composition range 0-40 at % B most of the B is present in a Li-rich phase, probably Li5B4. The electrical resistivity at room temperature was roughly constant between 0 and 45 at % B and then started to rise rapidly with increasing B. The Hall coefficient at room temperature was fairly constant from 0 to 40 at % B and then started to rise. The temperature dependence and magnitude of the electrical resistivity were metallic in nature, and there was no evidence of semiconducting behavior at higher B concentrations. There was a break in the resistivity of the 40 at % B sample at the melting point of Li indicating the presence of free Li, but not in the 50 to 60 at % B samples. It was possible to calculate the stoichiometry and density of the LiB phase (or phases) present in the 40 at % B sample: 55.3 at % Li and 1.07 g/cm cc, respectively, very close to the 55.6 at % Li and 1.0537 g/cm cc calculated for Li5B4 predicted from a recent X-ray and neutron diffraction structure study by Wang, et. al. GRA

N78-18326# Army Electronics Command, Fort Monmouth, N. J.
FOUR-POINT MOUNTING CONFIGURATION FOR RESONATORS SUBJECTED TO SEVERE ENVIRONMENTS
Arthur Ballato Nov. 1977 19 p refs
(AD-A048069; ECOM-4544) Avail: NTIS HC A02/MF A01 CSCL 09/5

AT-cut quartz plate resonators are usually edge mounted. For precision applications, and especially where ruggedness is required, a four-point mount is necessary. This report investigates those mounts consisting of two pairs of diametric attachments. For this class of mount a locus is found for the angles of attachment of the circular plate with respect to the crystallographic axes such that radially directed edge forces are compensated. One point on the locus is found to be particularly frequency insensitive to mounting errors, and defines the optimum setting for the four-point mount. Author (GRA)

N78-18327# Delta Electronic Control Corp., Irvine, Calif.
LOW-COST LIGHT-WEIGHT EFFICIENT 1.5 kW INVERTERS WITH AND WITHOUT OUTPUT TRANSFORMERS Final Report, Jun. 1976 - Jun. 1977
L. R. Suelzle and J. S. Suelzle Oct. 1977 100 p
(Contract DAAK02-74-C-0388)
(AD-A048449; DECC-61098-007) Avail: NTIS HC A05/MF A01 CSCL 10/2

Optimization efforts were completed on the 1.5 kW inverter described in report DECC-61098-003 (September 1975). A second inverter design was developed; in the second design the output transformer was eliminated. Tests were performed on both the optimized transformer-output inverter and the transformerless-output inverter. Tests included environmental tests on the transformer-output inverter. Author (GRA)

N78-18328# IBM Watson Research Center, Yorktown Heights, N.Y.
STUDY OF THE PHYSICS OF INSULATING FILMS AS RELATED TO THE RELIABILITY OF METAL-OXIDE SEMICONDUCTOR DEVICES Semiannual Technical Report, 17 Nov. 1976 - 16 May 1977
D. R. Young, T. DiStefano, D. J. DiMaria, J. M. Aitken, W. R. Hunter, K. Pan, C. M. Serrano, D. W. Ormond, M. Shatzkes, S. Pantelides et al Griffiss AFB, N. Y. RADC Sep. 1977 125 p refs
(Contract F19628-76-C-0249; ARPA Order 2180)
(AD-A048483; Scientific-2; RADC-TR-77-311) Avail: NTIS HC A06/MF A01 CSCL 20/12

The enclosed papers discuss the trapped hole location and annihilation in Si, current and C-V instabilities in SiO2 at high fields, annealing of neutral electron traps in irradiated oxides, Al implanted into the SiO2 layer of MOS structures, electron trapping as a result of Al implantation, the initial oxidation regime of silicon oxidation and the electronic structure of SiO2, SixGe(1-x)O2, GeO2. Author (GRA)

N78-18329# Harry Diamond Labs., Adelphi, Md.
COST AND RELIABILITY ASPECTS OF LARGE CMOS INTEGRATED CIRCUITS FOR FUZING APPLICATIONS
Barry H. Scheiner Nov. 1977 28 p refs
(AD-A048276; HDL-TM-77-32) Avail: NTIS HC A03/MF A01 CSCL 19/1

A complementary metal-oxide-semiconductor (CMOS) large-scale integrated circuit (LSIC) has been designed for use in the sensor of the XM75 Scatterable Mine. The CMOS digital technology lends itself to this application because of its low current drain and multiple sourcing of vendors. The cost of a CMOS LSIC is a function of the cost per electrically good die, the level of electrical and mechanical testing, and assembly and packaging costs. Circuit yields in terms of relative circuit areas are discussed in the literature according to assumed defect density distributions. Absolute yield data for production IC's have been obtained in personal communications with industry personnel. The stringency of the mechanical and environmental tests required for an IC will affect the final IC cost, since there is yield loss at both the wafer and the packaged device level. GRA

N78-18330# Air Force Weapons Lab., Kirtland AFB, N. Mex.
MODELING OF HIGH CURRENT INJECTION INTO BIPOLAR SEMICONDUCTORS Final Report
Edward O. Fuller Oct. 1977 27 p refs
(AD-A048781; AD-E200075; AFWL-TR-77-152) Avail: NTIS HC A03/MF A01 CSCL 20/12

Two techniques were used in an attempt to solve the problem of high current injection into a bipolar semiconductor. The first technique was by finite differences, and the second was by the method of lines. Because of the physical model chosen for the system, neither method would converge. An extended bibliography is included. Author (GRA)

N78-18331# Raytheon Co., Quincy, Mass.
MANUFACTURING METHODS AND TECHNOLOGY ENGINEERING (MM AND TE) PROGRAM FOR THE ESTABLISHMENT OF PRODUCTION TECHNIQUES FOR HIGH DENSITY THICK FILM CIRCUITS USED IN CRYSTAL OSCILLATORS Quarterly Progress Report, 28 Feb. - 29 May 1977
C. T. Martin and C. G. Morris 9 Sep. 1977 46 p refs
(Contract DAAB07-76-C-8119)
(AD-A048602; QPR-3) Avail: NTIS HC A03/MF A01 CSCL 09/1

Production techniques are being established for a thick film hybrid microelectronic 17-22 MHz temperature-compensated, voltage-controlled crystal oscillator. In the engineering phase of this program, the following was accomplished during this quarter: the procurement of microcircuit parts and bonding tools, continued procurement of hermetic sealing parts and materials, further test procedure generation, as well as test fixture fabrication. As part of the 10-lot substrate assembly task, TCFG and VCXO substrates were passively trimmed, assembled, and functionally trimmed. Because many problems developed during substrate assembly, hybrid layout redesigns were undertaken for both hybrids. Details of this work, as well as the problems encountered, are reported and documented. GRA

N78-18332# Institute for Defense Analyses, Arlington, Va. Program Analysis Div.
THE ROLE OF THE DEPARTMENT OF DEFENSE IN THE DEVELOPMENT OF INTEGRATED CIRCUITS Final Report
Norman J. Asher and Leland D. Strom May 1977 107 p refs
(Contract DAHC15-73-C-0200)
(AD-A048610; AD-E500005; IDA/HQ-77-19316) Avail: NTIS HC A05/MF A01 CSCL 09/5

The Department of Defense (DoD) was influential in the introduction of integrated circuits. This paper reviews the role played by DoD in their development and early use, and traces the resulting markets for integrated circuits and for products using integrated circuits. DoD provided R/D support during the early development of integrated circuits. Perhaps even more important was the creation of a market for integrated circuits through their incorporation into military systems. The early military market provided the 'learning curve' effect whereby unit prices decline as production proceeds. Within a few years, the integrated circuit unit price was low enough to penetrate the industrial market, and eventually the consumer market. In 1977, the value of integrated circuits being sold by U.S. firms was about $2.5 billion. However, integrated circuits are not an end product--they are only used in making other equipment. Hence,

the value of equipment incorporating integrated circuits is considerably greater. Author (GRA)

N78-18333# Hughes Aircraft Co., Culver City, Calif. Display System Lab.
PROGRAMMABLE IN-RASTER SYMBOL GENERATOR Final Report, 1 Apr. 1975 - 1 Jun. 1976
G. Wolfson Nov. 1977 67 p refs
(Contract N62269-75-C-0274)
(AD-A048596; HAC-P77-380; HAE-REF-D4846; NADC-77259-30) Avail: NTIS HC A04/MF A01 CSCL 09/2

A programmable symbol generator, in-raster buffer refresh memory and software development station was designed, fabricated and tested. The system was developed to meet the Navy's needs for improved reliability vertical situation displays for advanced weapon systems. This report documents the last phase of a four phase study and development program sponsored by NADC. Also included in this report is a discussion of color requirements and a survey of color display technology.
Author (GRA)

N78-18334# Raytheon Co., Waltham, Mass. Special Microwave Devices.
MANUFACTURING METHODS AND TECHNOLOGY ENGINEERING HIGH-EFFICIENCY, HIGH-POWER GALLIUM ARSENIDE READ-TYPE IMPATT DIODES, VOLUME 2 Final Report, 30 Jun. 1975 - 30 Jun. 1977
H. R. Chalifour and S. R. Steele 30 Jun. 1977 161 p
(Contract DAAB07-75-C-0045)
(AD-A048579; Rept-0877-1397-Vol-2) Avail: NTIS HC A08/MF A01 CSCL 09/1

This volume includes all of the process specifications for the High-Power, High-Efficiency Gallium-Arsenide IMPATT Diode. The detailed process sheets are grouped in accordance with the particular process area where they are used. A flow chart for each group shows the interrelationship of operations. Applicable drawings are also included in Section II. GRA

N78-18335# Raytheon Co., Waltham, Mass. Special Microwave Devices.
MANUFACTURING METHODS AND TECHNOLOGY ENGINEERING HIGH-EFFICIENCY, HIGH-POWER GALLIUM ARSENIDE READ-TYPE IMPATT DIODES, VOLUME 1
H. R. Chalifour and S. R. Steele Aug. 1977 187 p
(Contract DAAB07-75-C-0045)
(AD-A048578; Rept-0877-1393-Vol-1) Avail: NTIS HC A09/MF A01 CSCL 09/1

A design review of Read profile IMPATT diodes is presented. Work performed on this program to achieve the target specifications for high power X-band and Ku-band diodes is summarized. This includes development of specifications, processes, and characterization techniques for the Gallium Arsenide epitaxial wafer, as well as assembly and test procedures for the diode. Areas of investigation included epitaxial wafer growth processes, methods of controlling layer axial and radial uniformity, and techniques for testing the completed wafer. Schottky-barrier metallization and dimensional control techniques during plating, lapping and etching were the principal areas of investigation in the dice processing area. Several novel techniques were applied to the manufacturing processes to improve the production rates of Read IMPATT diodes. This included spray dicing of the wafers, and new thermal resistance and noise measuring techniques. Environmental test results are summarized, including storage and operating life test results during the program and on the final production units. Author (GRA)

N78-18336# Naval Research Lab., Washington, D. C.
REFLEX TETRODE WITH UNIDIRECTIONAL ION FLOW Interim Report
J. A. Pasour, R. A. Mahaffey, Jeffry Golden, and Christos A. Kapetanakos Nov. 1977 12 p refs
(RR0110941)
(AD-A048751; AD-E000073; NRL-MR-3670) Avail: NTIS HC A02/MF A01 CSCL 09/1

Experimental results are reported which show that the backward directed (and unusable) ion current in a reflex triode can be almost completely suppressed by adding a second anode, made of aluminized mylar, 0.5 cm from the existing polyethylene anode. Proton generation efficiencies in excess of 50% have been obtained. Author (GRA)

N78-18337# Texas Instruments, Inc., Dallas.
MICROSTRIP REFLECTARRAY ANTENNA PROGRAM Final Report, 14 Apr. 1976 - 14 Apr. 1977
Frank Opp and James P. Montgomery Aug. 1977 76 p refs
(Contract F30602-76-C-0226)
(AD-A048480; TI-U1-726210-F; RADC-TR-77-296) Avail: NTIS HC A05/MF A01 CSCL 09/5

Results of a study to determine the feasibility and design limitations of a microstrip reflectarray antenna are presented. This antenna, which has been proposed as a means to provide potential low-cost corporate-fed phased arrays, utilizes microwave integrated circuit techniques to integrate the radiating element, phase-shifter components, dc distribution, and logic circuitry into a single structure. The report contains design and performance data on such an element operating at 3 GHz. The performance was measured using a waveguide test fixture to simulate the array. Fundamental element performance is in agreement with the results of supporting analysis. The usefulness of the element in an array is severely restricted by very narrow bandwidths and relatively high losses. However, supporting theoretical analysis showed the element's loss and operating bandwidth are a strong function of the element spacing in an array environment. Results indicate reduced loss and increased bandwidth with decreased spacing, thereby suggesting that the present performance deficiencies could be overcome.
Author (GRA)

N78-18338# Texas Instruments, Inc., Dallas. Central Research Labs.
MICROBEAM ANALYSIS TECHNIQUES FOR ICS Final Technical Report, 9 Jun. 1976 - 9 Mar. 1977
G. B. Larrabee and R. D. Dobrott Oct. 1977 230 p
(Contract F30602-76-C-0316)
(AD-A048482; TI-08-77-16; RADC-TR-77-339) Avail: NTIS HC A11/MF A01 CSCL 20/12

The ion microprobe mass analyzer was used for a general chemical characterization of actual integrated circuits. The analysis technique was designed to determine impurities at the surface, in the deposited oxide, in the thermal oxide, in the metallization, and at the various interfaces between these layers. The identification of the intentional dopants in the silicon was performed where concentrations were above the detection limit. In-depth concentration profiles of intentional dopants such as phosphorus were obtained by monitoring the dopant ion signal as a function of sputter time. A quantitative estimate of some of the common dopants and/or impurities was accomplished using an emperical calibration. Depths were determined by emperically calibrating the sputter rates as a function of area, total primary ion current, and primary ion species. Interface regions were identified by sputter time analysis of layers where successive layers have an elemental matrix change. The interfaces between layers of similar matrix elements, such as deposited oxide thermal oxide were assumed to have the same sputter time as dissimilar matrices, i.e., deposited oxide over metal has the same thickness and sputter characteristics as over thermal oxide. Negative or positive oxygen was used as the primary sputtering ion for data collection. Positive argon was used as the primary sputtering ion for data collection. Positive argon was used to rapidly sputter through layers for interfacial analysis. GRA

N78-18339# National Bureau of Standards, Boulder, Colo. Electromagnetics Div.
THE CHARACTERISTICS OF BROADBAND, ISOTROPIC ELECTRICAL FIELD AND MAGNETIC FIELD PROBES
Motohisa Kanda Nov. 1977 35 p refs
(PB-274457/1; NBSIR-77-868) Avail: NTIS HC A03/MF A01 CSCL 14B

A feasibility study and a preliminary engineering test program were conducted to establish performance specification limits and preliminary engineering design for broadband, isotropic, receiving, electric field and magnetic field probes for electromagnetic emission measurements. Three electric field probes covered the frequency range from 20 Hz to 12 GHz. Two magnetic field probes covered the frequency range from 20 Hz to 32 MHz. The tangential sensitivities and the dynamic range of these

broadband isotropic electric field and magnetic field probes were specified. Preliminary engineering design and supporting test data were included. Author

N78-18340# Oak Ridge National Lab., Tenn.
DESIGN OF SUPERCONDUCTING TOROIDAL MAGNET COILS AND TESTING FACILITY IN THE USA
J. N. Luton, P. N. Haubenreich, and P. B. Thompson 1977 6 p refs Presented at 6th Intern. Conf. on Magnet Technol., Bratislava, 29 Aug. 1977
(Contract W-7405-eng-26)
(CONF-770842-5) Avail: NTIS HC A02/MF A01

Test coils were designed approximately half the bore size of reactor coils, being oval or D-shaped, with a bore of 2.5 x 3.5 m. The dimensions and operating requirements of the coils are identical for all test coils. The coils were designed to produce a peak field of at least 8 tesla at the winding of a selected coil operated at its design current. This condition is met when the selected coil is operated in a compact toroidal array of 6 coils, with the other five coils being operated at 0.8 of their design current. The six coils are of three different designs. Both pool boiling and forced flow designs are included. The coils are housed in a single large vacuum chamber for economy and testing convenience. Auxiliary coils provided a pulse field over the test coil winding volume. This auxiliary system is designed to produce a pulse field which rises to peak of 0.14 T in 1 sec. With the exception of material damage due to neutron irradiation, all reactor requirements and environments will be either duplicated, approximated, or simulated. The test facility is being designed to accept coils producing up to 12 tesla. ERA

N78-18341# European Space Agency, Paris (France).
COMPUTER AIDED ANALYSIS OF MICROWAVE ELECTRONIC CIRCUITS IN THE FREQUENCY DOMAIN (ESAMEC)
J. G. Ferrante, J. K. Nielsen, and A. Montenegro Dec. 1977 46 p refs Transl. into ENGLISH from the ESA Journal (Paris), v. 1, no. 1, 1977 p 87-112 Original report in FRENCH previously announced as A77-36230
(ESA-TT-441) Avail: NTIS HC A03/MF A01

Two general methods are presented for microwave network analysis to be integrated into computer-aided design software known as ESAMEC (ESA Microwave Electronic Circuits). They are the wiring operator method, based on the equivalent representation of transfer matrices, and the nodal analysis method using an infinite admittance matrix. ESAMEC is applied to the failure-mode analysis of a variable phase shift network, using PIN diodes, to be flown aboard Meteosat. Author (ESA)

N78-18342# Lyon Univ. (France). Inst. de Physique Nucleaire.
AN ELECTRIC CURRENT PREAMPLIFIER ASSOCIATED TO THE CATHODIC PLANES OF PROPORTIONAL MULTIWIRE CHAMBERS [ETUDE D'UN PREAMPLIFICATEUR DE COURANT ASSOCIE AUX PLANS CATHODIQUES DE CHAMBRES PROPORTIONNELLES MULTIFILS]
M. Goyot, J. P. Buro, M. Chemarin, M. Chevalier, B. Ille, M. Lambert, and J. P. Martin Jan. 1977 20 p refs In FRENCH
(LYCEN-7705) Avail: NTIS HC A02/MF A01

An electrical current preamplifier is described for use with multiwire spark chambers used as proportional counters. The experimental environment is described, the hybrid analogic preamplifier principle is detailed, and the implementation is discussed with regard to SN ratio and frequency responses. Experimental results pertaining to detection geometry, gain, and energy resolution are given. ESA

N78-18343# Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
ANALYSIS OF LEAK CURRENTS IN FIELD EFFECT TRANSISTORS WITH A SUBMICRON SCHOTTKY GATE Final Report [ANALYSE DES COURANTS DE FUITE DANS LES TRANSISTORS A EFFET DE CHAMP A GRILLE SCHOTTKY SUBMICRONIQUE]
Gerard Nuzillat, Christian Arnodo, and Pierre Morel Jul. 1976 53 p refs In FRENCH Sponsored by Delegation Gen. a la Rech. Sci. et Tech.
(LCR-450/258) Avail: NTIS HC A04/MF A01

Field effect transistors were examined with a Schottky gate (MESFET) and an implanted N channel, integrated on P- silicon and having the following characteristics: gate length L between 0.5 and 3 micron, pinch voltage Vp between 0.35 and 1.5 V. These components have intrinsic leaks which are superposed on the ideal useful current and the amplitude of which increases rapidly when L reduces below about 1 micron. Two mechanisms are distinguished: linear saturation leaks, to be explained by a pronounced vertical asymmetry of the device, and quadratic leaks when blocking, due to a limited space charge injection into the substrate. Boron ion implantation below the channel allows considerable reduction of these intrinsic leaks. A physical model was established, based on a pseudo two-dimensional analysis, which can be used for simulation of logic circuits. ESA

N78-18344# Istituto Superiore di Sanita, Rome (Italy). Lab. di Fisica.
AMPLIFICATION AND DISCRIMINATION OF SIGNALS FROM PROPORTIONAL MULTIWIRE CHAMBERS
L. Papadopoulos, C. Bosio, and M. Cordelli 22 Mar. 1976 13 p refs
(ISS-T-76/6) Avail: NTIS HC A02/MF A01

A circuit is described which detects signals from proportional multiwire chambers. The threshold is about 3 microampere and the time jitter of the pulse obtained is better than 2.5 ns. The circuit has one negative input and two complementary outputs. The module attained includes eight channels with common trigger level control and was built as NIM standard unit. Author (ESA)

N78-18345# RCA Labs., Princeton, N. J.
SEMICONDUCTOR MEASUREMENT TECHNOLOGY: A VERSATILE HIGH-VOLTAGE BIAS SUPPLY FOR EXTENDED RANGE MIS C(V) AND G(V) MEASUREMENTS
Paul Kuczer, Harvey O. Hook, and Alvin M. Goodman Washington NBS Dec. 1977 72 p refs
(Contract NBS-5-35912; ARPA Order 2397)
(PB-274939/8; NBS-SP-400-41; LC-77-25245) Avail: NTIS HC A04/MF A01 CSCL 14B

A versatile high-voltage power supply intended for use as a bias source in carrying out such measurements is described. The design allows the user a wide variety of options in the selection of the sweep function (waveform), sweep time, initial bias voltage, and the amplitude of the bias sweep. There are six possible sweep functions: (1) increasing ramp, (2) decreasing ramp, (3) positive polarity half-wave sawtooth (increasing ramp followed by decreasing ramp), (4) negative polarity halfwave sawtooth (decreasing ramp followed by increasing ramp), (5) full-wave sawtooth starting with increasing ramp, and (6) full-wave sawtooth starting with decreasing ramp. GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N78-18346 Texas Univ., Austin.
DIFFUSION IN A TEMPERATURE GRADIENT Ph.D. Thesis
Shin-Min Shih 1977 75 p
Avail: Univ. Microfilms Order No. 77-23033

The diffusion of Ag-110 in single crystals of silver copper in a temperature gradient was studied in an effort to determine the local vacancy concentrations in these metals under the nonisothermal condition. Pure single crystal samples of silver and copper were subjected to different temperature gradients with the hot end at 930 C and 1000 C, respectively. The diffusivity of Ag-110 at the cold end of a sample was measured. The least squares line of the nonisothermal diffusivities for silver self diffusion is described. Results indicate that in single crystals of silver and particularly in copper, no significant departure from the local thermal equilibrium vacancy concentrations occurs.
Dissert. Abstr.

N78-18347 Louisiana State Univ. and A&M Coll., Baton Rouge.
CYLINDER DRAG AT LOW REYNOLDS NUMBER Ph.D. Thesis
Burke Huner 1977 59 p
Avail: Univ. Microfilms Order No. 77-28680

From terminal velocity measurements of solitary finite length circular cylinders settling in a large rectangular tank of fluid, drag values for infinite length circular cylinders translating at constant speed through an unbounded fluid were obtained. The drag was determined as the effective weight of the cylinder in the liquid and the Reynolds number was determined from the terminal velocity measurements by the time of flight method. The effects of finite length and finite boundaries were accounted for by empirical corrections. The effects of the container endwalls and bottom were observed to be negligibly small. The sidewalls caused a variation in the terminal velocity proportional to the reciprocal of the wall separation squared. When the influence of the side walls was removed, it was found that the reciprocal of the terminal velocity was linearly proportional to the reciprocal of the length. Dissert. Abstr.

N78-18348 Washington Univ., Seattle.
MOMENTUM DISTRIBUTIONS AND ONE-BODY DENSITY MATRICES OF THE QUANTUM FLUIDS Ph.D. Thesis
Pui-Man Lam 1977 184 p
Avail: Univ. Microfilms Order No. 77-30160

The one body density matrix n(r) and the associated momentum distribution n(q) (for given spin-isospin projection) were calculated for the ground states of liquid He4, based on suitable Jastrow wavefunctions psi = pi f(r sub ij)phi when i is less than j. The model function phi was taken as the ground state wavefunction of a system of non-interacting bosons or fermions, as appropriate. The results presented for the helium liquids are of considerable interest in connection with proposed scattering experiments using intense neutron beams.
Dissert. Abstr.

N78-18349 Florida Univ., Gainesville.
EXPERIMENTAL AND ANALYTICAL STUDY ON THE STABILITY OF A BOUNDED JET AT LOW REYNOLDS NUMBERS Ph.D. Thesis
Juan Luis Lopez 1977 208 p
Avail: Univ. Microfilms Order No. 77-29265

A series of steady flow experiments were described in which hydrodynamic factors are considered for the axisymmetric jet formed downstream of symmetric constrictions in circular pipes. Results were obtained for several ratios of test section to constriction diameter, within a Reynolds number range from approximately 50 to 2000. The critical Reynolds number for onset of velocity undulations was evaluated for a wide range of area ratios using a non-disturbing flow visualization technique, based on the double refracting properties of an aqueous colloidal solution of White Hector bentonite. Dissert. Abstr.

N78-18350 Maryland Univ., College Park.
ON THE PREDICTION OF MASS FLOW RATES OF PROPANE Ph.D. Thesis
Frank Kuoeng Wu 1977 198 p
Avail: Univ. Microfilms Order No. 77-29141

The thermodynamic properties of propane, propylene, and n-butane and of a mixture consisting of 65% propane, 25% propylene, and 10% n-butane were calculated using virial equations of state. The particular virial equations chosen for the calculations were those by Benedict-Webb-Rubin and by Starling. Starling's equation resulted in thermodynamic properties which were most consistent and compared best with measured values. Extensive saturation temperature tables for propane, propylene, n-butane, and a pseudofluid consisting of a mixture of propane, propylene, and n-butane are presented. While the Benedict-Webb-Rubin and Starling equations were used for the calculation of the properties of pure propane and the respective results listed in separate tables, the results given for propylene, n-butane, and the hydrocarbon mixture were based on Starling's equation.
Dissert. Abstr.

N78-18351 Maryland Univ., College Park.
UNCONFINED THERMAL DISCHARGES NEAR FREE SURFACES Ph.D. Thesis
Jiin Piau Wei 1976 166 p
Avail: Univ. Microfilms Order No. 77-28760

The problem of discharging hot condenser cooling water from a power plant into a nearby natural body of water was considered in regard to thermal pollution control. An analytical and experimental study of shallow submerged two dimensional heated jets emanating from a slot into an ambient temperature water channel was conducted. Information on the free mixing of the jets near and at the free surface with no confinement at the jet exit plane was presented to elucidate the differences between the jets and those with confinement. In addition, results of the temperature distribution in the receiving water as a function of the initial temperature difference between the heated discharge and the ambient water, the slot height, and the submergency are presented. Dissert. Abstr.

N78-18352 Colorado State Univ., Fort Collins.
IGNITION CRITERIA FOR NON-PREMIXED STAGNATION POINT FLOW Ph.D. Thesis
John Gilbert Taylor 1977 159 p
Avail: Univ. Microfilms Order No. 77-28332

The problem of chemical reaction and ignition in the stagnation point boundary layer of a compressible flow was examined using the finite rate chemical kinetics characteristic of the weak burning region (relatively small Damkohler number) which is typical of the ignition regime in non-premixed combustion. Reaction is restricted to the gas phase and is modeled as a second order reaction following Arrhenius kinetics. The method for establishing Damkohler ignition criteria is demonstrated for an acetone-air system, and Damkohler ignition numbers were determined for the range of freestream temperatures 661 to 1189 degrees Rankine. In addition, perturbation profiles of temperature, velocity, and fuel and oxidant concentration detailing the behavior of the system in the weak burning region are presented. A comparison with available experimental results indicates reasonable qualitative agreement. Dissert. Abstr.

N78-18353 Washington Univ., St. Louis, Mo.
AN EXAMINATION OF COMBINED FREE AND FORCED CONVECTION PHENOMENA IN A DENSITY-STRATIFIED FLUID Ph.D. Thesis
James Paul Shawcross 1977 263 p
Avail: Univ. Microfilms Order No. 77-28343

An experimental system was used to simulate the atmospheric phenomenon known as the urban heat island. Ground level temperature patterns were observed by cementing strips of temperature sensitive liquid crystal paper over the model heat island surface. It was shown that downstream thermal ground level diffusion appeared only in the presence of a very strong ambient stability field. The first flow type investigated was the free convection heat island which occurred in the absence of a horizontal mean flow field. The second major circulation type was the combined free and forced convection mode which appeared whenever a finite horizontal mean velocity was applied. The model data was shown to predict observed critical velocity levels in a number of urban areas. Dissert. Abstr.

N78-18354 Kansas Univ., Lawrence.
DEFLECTED HEATED WATER JETS, THEORY AND EXPERIMENTS Ph.D. Thesis
Surinder Kumar Kaul 1977 121 p
Avail: Univ. Microfilms Order No. 77-29188

A simple one dimensional mathematical model based on an entrainment concept was developed. The entrainment function is assumed to depend on the distance along the jet axis, the jet and ambient flow velocity ratio and the jet entry. Equations representing the conservation of mass, momentum and heat are integrated in a closed form. Experiments were conducted in a rectangular open channel at various jet to ambient flow velocity ratios. For submerged jets, experiments were also conducted at varying water depth but kept the velocity ratio constant. The differential temperature between the heated jet and the ambient water was about 20 F. Temperature, velocity and turbulence measurements were made. The predicted average temperatures are generally lower than the experimental values. Dissert. Abstr.

N78-18355* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THERMAL BARRIER COATING SYSTEM Patent
Stephan Stecura and Curt H. Leibert, inventors (to NASA) Issued 25 Oct. 1977 3 p Filed 14 May 1978 Supersedes N76-23359 (14 - 14, p 1773)
(NASA-Case-LEW-12554-1; US-Patent-4,055,705; US-Patent-Appl-SN-686449; US-Patent-Class-428-633; US-Patent-Class-428-652; US-Patent-Class-428-667; US-Patent-Class-427-405; US-Patent-Class-427-419A; US-Patent-Class-427-34; US-Patent-Class-427-423) Avail: US Patent Office CSCL 20D

A coating system which contains a bond coating and a thermal barrier coating is applied to metal surfaces such as turbine blades and provides both low thermal conductivity and improved adherence when exposed to high temperature gases or liquids. The bond coating contains NiCrAlY and the thermal barrier coating contains a reflective oxide. The reflective oxides ZrO2-Y2O3 and ZrO2-MgO have demonstrated significant utility in high temperature turbine applications.
Official Gazette of the U.S. Patent Office

N78-18356 California Univ., Berkeley.
A NUMERICAL INVESTIGATION OF CONFINED TURBULENT SHEAR FLOWS Ph.D. Thesis
Peter Simon Bernard 1977 161 p
Avail: Univ. Microfilms Order No. 77-31288

The first objective of this work was to present a new derivation of the method of coarse graining for the computation of turbulent flows. The work presented was primarily concerned with two dimensional flow. The principal improvement in the method of coarse graining consists of the establishment of a new general law of turbulent diffusion which applies to any scalar that is passively convected in a turbulent flow. The law was in the form of an expansion in roughly the Lagrangian integral time scale. The transport law was used to derive a closed set of equations for the mean vorticity and mean squared fluctuating vorticity. Other innovations included a more precise accounting of the effects of the local turbulence on the velocity moments and the use of an explicit equation for mean squared fluctuating vorticity instead of mean squared vorticity. Dissert. Abstr.

N78-18357*# National Aeronautics and Space Administration, Washington, D. C.
HEAT PIPES AND THEIR USE IN TECHNOLOGY
L. Vasilyev Aug. 1977 7 p Transl. into ENGLISH from Inzh.-Fiz. ZH. (USSR), v. 31, no. 5, Nov. 1976 p 905-907 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(NASA-TM-75148) Avail: NTIS HC A02/MF A01 CSCL 20D

Heat pipes may be employed as temperature regulators, heat diodes, transformers, storage batteries, or utilized for transforming thermal energy into mechanical, electric, or other forms of energy. General concepts were established for the analysis of the transfer process in heat pipes. A system of equations was developed to describe the thermodynamics of steam passage through a cross section of a heat pipe. P.R.A.

N78-18358*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TURBULENT BOUNDARY LAYERS OVER NONSTATIONARY PLANE BOUNDARIES
Alan T. Roper (Rose-Hulman Inst. of Technology, Terre Haute, Indiana) and Garl L. Gentry, Jr. Feb. 1978 64 p refs
(NASA-TM-74091; L-11465) Avail: NTIS HC A04/MF A01 CSCL 20D

Methods of predicting integral parameters and skin friction coefficients of turbulent boundary layers developing over moving ground planes were evaluated. The three methods evaluated were: relative integral parameter method; relative power law method; and modified law of the wall method. Author

N78-18359*# Grumman Aerospace Corp., Bethpage, N.Y.
CAVE3: A GENERAL TRANSIENT HEAT TRANSFER COMPUTER CODE UTILIZING EIGENVECTORS AND EIGENVALUES
Joseph V. Palmieri and Kenneth A. Rathjen Feb. 1978 175 p refs
(Contract NAS1-14643)
(NASA-CR-145290) Avail: NTIS HC A08/MF A01 CSCL 20D

The method of solution is a hybrid analytical numerical technique which utilizes eigenvalues and eigenvectors. The method is inherently stable, permitting large time steps even with the best of conductors with the finest of mesh sizes which can provide a factor of five reduction in machine time compared to conventional explicit finite difference methods when structures with small time constants are analyzed over long time periods. This code will find utility in analyzing hypersonic missile and aircraft structures which fall naturally into this class. The code is a completely general one in that problems involving any geometry, boundary conditions and materials can be analyzed. This is made possible by requiring the user to establish the thermal network conductances between nodes. Dynamic storage allocation is used to minimize core storage requirements. This report is primarily a user's manual for CAVE3 code. Input and output formats are presented and explained. Sample problems are included which illustrate the usage of the code as well as establish the validity and accuracy of the method. Author

N78-18360# National Aeronautical Lab., Bangalore (India). Structural Sciences Div.
TRANSIENT TEMPERATURES IN LAMINATED COMPOSITE CONICAL SHELLS DUE TO AERODYNAMIC HEATING
B. Basava Raju, Ramesh Chandra, and M. Subba Rao 1 Feb. 1978 33 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in Jun. 1978
Avail: NTIS HC A03/MF A01

Transient temperatures in laminated composite conical shells, subjected to aerodynamic heating, were studied. One edge was at the prescribed temperature and the other edge was insulated. The outer surface of the conical sheel was subjected to linear heat transfer due to aerodynamic heating. Transient heat conduction equations for a laminated composite conical shell were formulated, and solved for axisymmetric heat input by employing Laplace transform technique in conjunction with Galerkin's method. In the numerical work, the effect of various parameters like thickness ratio, cone angle, fibre orientation, and material system of cone on temperature distribution are presented in the form of curves. Author

N78-18361# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Mechanical Engineering.
MEASURED REYNOLDS STRESS TENSORS IN A THREE-DIMENSIONAL TURBULENT BOUNDARY LAYER
C. I. Ezekwe (Nigeria Univ.), F. J. Pierce, and J. E. McAllister 26 Sep. 1977 37 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in Jun. 1978
(Contract DAHC04-67-C-0008)
Avail: NTIS HC A03/MF A01

An extensive experimental investigation is reported in which all six unknown elements of the Reynolds stress tensor as well as the mean velocity field were measured through a pressure driven, three dimensional turbulent boundary layer with moderate skewing relative to the free stream direction. The turbulent stresses were measured by the rotating probe technique. Measured turbulent shear stresses and the mean velocity field data are compared with values obtained from a numerical solution for the boundary layer flow. Moderate to good agreement exists between the measured values and those computed for an isotropic mixing length model. Author

N78-18362*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FOREBODY AND AFTERBODY SOLUTIONS OF THE NAVIER-STOKES EQUATIONS FOR SUPERSONIC FLOW OVER BLUNT BODIES IN A GENERALIZED ORTHOGONAL COORDINATE SYSTEM
Peter A. Gnoffo Feb. 1978 89 p refs
(NASA-TP-1075; L-11770) Avail: NTIS HC A05/MF A01 CSCL 20D

A coordinate transformation, which can approximate many different two-dimensional and axisymmetric body shapes with an analytic function, is used as a basis for solving the Navier-Stokes equations for the purpose of predicting 0 deg angle of attack supersonic flow fields. The transformation defines a curvilinear, orthogonal coordinate system in which coordinate lines are perpendicular to the body and the body is defined by one coordinate line. This system is mapped in to a rectangular

computational domain in which the governing flow field equations are solved numerically. Advantages of this technique are that the specification of boundary conditions are simplified and, most importantly, the entire flow field can be obtained, including flow in the wake. Good agreement has been obtained with experimental data for pressure distributions, density distributions, and heat transfer over spheres and cylinders in supersonic flow. Approximations to the Viking aeroshell and to a candidate Jupiter probe are presented and flow fields over these shapes are calculated. Author

N78-18363*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INVISCID, NONADIABATIC FLOW FIELDS OVER BLUNT, SONIC CORNER BODIES FOR OUTER PLANET ENTRY CONDITIONS BY A METHOD OF INTEGRAL RELATIONS
Peter A. Gnoffo Feb. 1978 52 p refs
(NASA-TP-1133; L-11944) Avail: NTIS HC A04/MF A01 CSCL 20D

An investigation has been made into the ability of a method of integral relations to calculate inviscid zero degree angle of attack, radiative heating distributions over blunt, sonic corner bodies for some representative outer planet entry conditions is investigated. Comparisons have been made with a more detailed numerical method, a time asymptotic technique, using the same equilibrium chemistry and radiation transport subroutines. An effort to produce a second order approximation (two-strip) method of integral relations code to aid in this investigation is also described and a modified two-strip routine is presented. Results indicate that the one-strip method of integral relations cannot be used to obtain accurate estimates of the radiative heating distribution because of its inability to resolve thermal gradients near the wall. The two-strip method can sometimes be used to improve these estimates; however, the two-strip method has only a small range of conditions over which it will yield significant improvement over the one-strip method. Author

N78-18364*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
EFFECTIVE THERMAL CONDUCTIVITY DETERMINATION FOR LOW-DENSITY INSULATING MATERIALS
S. D. Williams (Lockheed Electronics Co., Houston, Tex.) and Donald M. Curry Feb. 1978 25 p refs
(NASA-TP-1155; S-481) Avail: NTIS HC A02/MF A01 CSCL 20D

That nonlinear least squares can be used to determine effective thermal conductivity was demonstrated, and a method for assessing the relative error associated with these predicted values was provided. The differences between dynamic and static determination of effective thermal conductivity of low-density materials that transfer heat by a combination of conduction, convection, and radiation were discussed. Author

N78-18365# Neilsen Engineering and Research, Inc., Mountain View, Calif.
TESTING OF TURBULENCE MODELS BY EXACT NUMERICAL SOLUTION OF THE NAVIER-STOKES EQUATIONS Annual Technical Report, 1 Nov. 1976 - 31 Oct. 1977
Joel H. Ferziger and Oden J. McMillan 4 Nov. 1977 56 p refs
(Contract N00014-77-C-0008)
(AD-A048199; NEAR-TR-155) Avail: NTIS HC A04/MF A01 CSCL 20/4

This report presents preliminary results from a continuing study in which the validity of models used in large-eddy simulations of turbulent flow is tested by comparison with results from an exact simulation using the Navier-Stokes equations. The results to date are for models of the eddy-viscosity type applied to a homogeneous isotropic incompressible flow. More complicated flows and models will be considered in future phases of this study. Author (GRA)

N78-18366# Naval Civil Engineering Lab., Port Hueneme, Calif.
CABLE STRUMMING SUPPRESSION Technical Note, Apr. - Jun. 1976
B. E. Hafen and D. J. Meggitt Sep. 1977 107 p refs
(YF52556091)
(AD-A047996; CEL-TN-1499) Avail: NTIS HC A06/MF A01 CSCL 13/9

This report presents a consolidation of existing data on various devices used to suppress vortex-induced motions of cables and circular cylinders in the ocean. The types of devices discussed herein include 'fringe,' 'hair,' and ribbon flexible fairings and helical ridges. In general, the available data show that all of these methods do, in fact, suppress vortex-induced vibrations to a greater or lesser degree. However, because of the diverse ways in which suppression effectiveness has been measured, comparisons among different types of devices are difficult to make. Criteria for such comparisons are suggested. Relatively few measurements of the effects of strumming suppression devices on the drag of a cable or cylinder have been reported. The available data indicate that a large drag penalty may be incurred by use of such devices, depending on the configuration employed. Author (GRA)

N78-18367# California Univ., Los Angeles. Dept. of Mechanics and Structures.
THE FORMATION AND STABILITY OF LONGITUDINAL ROLL VORTICES IN SHEAR FLOWS Final Report, 1 Jun. 1972 - 31 May 1977
Robert E. Kelly May 1977 24 p refs
(Contract DA-ARO-(D)-31-124-72-G168)
(AD-A048691; UCLA-ENG-7737; ARO-10112.7-E) Avail: NTIS HC A02/MF A01 CSCL 20/4

Longitudinal roll vortices occur frequently in shear flows. Although they are most commonly driven by body forces (either centrifugal or buoyant), they are also observed during transition in homogeneous boundary layers. Under the above grant, various investigations have been made of their formation and, for the case of thermally driven vortices, their own instability. This report summarizes the results obtained. More detailed results can be found in the journal publications referred to in the report. Author (GRA)

N78-18368# Naval Research Lab., Washington, D. C.
TRANSIENT FREE-SURFACE HYDRODYNAMICS Interim Report
M. J. Fritts Nov. 1977 38 p refs
(RR0110941)
(AD-A048749; AD-E000071; NRL-MR-3651) Avail: NTIS HC A03/MF A01 CSCL 20/4

The control volume approach is used to obtain a finite-difference scheme for a Lagrangian formulation of inviscide incompressible flow using an irregular triangular mesh. The method permits grid reconnections and allows local vertex addition and deletion. Algorithms are presented which conserve divergence, vorticity, mass, momentum and energy even during grid restructuring. Examples are taken from simulations of shear flow and flow over a hydrofoil in which the restructuring algorithms are crucial. Although the structure of the code is highly scalar, techniques are outlined for producing efficient code even for the new vector computers. Author (GRA)

N78-18369# Aerospace Corp., El Segundo, Calif. Ivan A. Getting Labs.
ESTIMATES OF TURBULENT BOUNDARY LAYER BEHIND A SHOCK WAVE MOVING WITH UNIFORM VELOCITY Interim Report
Harold Mirels 8 Dec. 1977 36 p
(Contract F04701-77-C-0078)
(AD-A048445; TR-0078(3781-02)-1; SAMSO-TR-77-166) Avail: NTIS HC A03/MF A01 CSCL 20/4

A theory, previously presented by the author, concerning turbulent boundary-layer development behind a shock moving with uniform speed is briefly reviewed. Numerical results for boundary-layer properties are presented for shock propagation in air at Mach numbers in the range $1.01 < \text{or} = M_S < \text{or} = 20$. The heat transfer results are in good agreement with the shock tube wall heat transfer measurements of Hartunian et al., which were made in the range $3 < \text{or} = M_S < \text{or} = 8$. Approximate analytical expressions for turbulent boundary-layer properties are deduced, and estimates of the wall temperature variation with distance behind the shock (assumed small) are given. Effects of blowing (wall ablation) are also estimated. The need for experimental data to confirm large Mach number and blowing effects predictions is also noted. Author (GRA)

N78-18370# National Bureau of Standards, Washington, D. C. Fluid Meters Section.

A COMPUTER CODE FOR THE SIMULATION OF TURBULENT SWIRLING FLOW THROUGH CLOSED-CONDUIT FLOW METERS Final Report

R. W. Davis and E. F. Moore Dec. 1977 13 p refs
(PB-274650/1; NBSIR-77-1394) Avail: NTIS HC A02/MF A01 CSCL 20D

A computer code is presented for the simulation of turbulent swirling flow through closed conduit flow meters. The code is reasonably fast and accurate. The response of a flow meter to changes in its operating environment is easily assessed. Through the use of computer plotting routines, a complete picture of the flowfield through a meter can be obtained. An example flow field for a target meter was given. GRA

N78-18371# National Aerospace Lab., Amsterdam (Netherlands). Scientific Services.

A SIMPLE FINITE DIFFERENCE TECHNIQUE FOR THE COMPUTATION OF THREE-DIMENSIONAL INCOMPRESSIBLE LAMINAR BOUNDARY LAYERS. PART 1: DESCRIPTION OF THE METHOD

J. P. F. Lindhout and E. DeBoar 16 Sep. 1976 37 p refs
(Contract NIVR-1737)
(NLR-TR-76086-U) Avail: NTIS HC A03/MF A01

A finite difference scheme for the computation of 3D laminar boundary layers over various surfaces is described. The stability of the first variation of the difference scheme is investigated. Some results of actual boundary layer calculations are presented for flows over swept wings. ESA

N78-18372# Aeronautical Research Inst. of Sweden, Stockholm. Fluid Technology Lab.

FLEXNOZZLE STEERING OF A FLUID JET

R. F. Boucher (Sheffield Univ., Engl.) and K. S. Nystroem 30 Aug. 1977 19 p refs
(FFA-Memo-114) Avail: NTIS HC A02/MF A01

The principle of flexnozzle steering is described and the results of a theoretical and experimental investigation of the method are given. Flexnozzle steering is accomplished by small movement of one part of a nozzle relative to the other part. The case presented here involves the movement of one side of a sharp-edged two-dimensional nozzle in a direction parallel to the nozzle centerline. Measurements of the resulting deflection angle and flow changes with area and coefficient of discharge are compared with the theory. Of the many possible applications of the technique, a new diverter valve which has been successfully used in mining ventilation is described briefly. Author (ESA)

N78-18373# Oxford Univ. (England). Engineering Lab.

STUDIES OF GAS INJECTION INTO A LIQUID STREAM Final Report

D. B. R. Kenning and J. McMillan Sep. 1977 131 p refs
(Contract AT/2057/048-ARL)
(OUEL-1216/77) Avail: NTIS HC A07/MF A01

Gas injection into a liquid stream was studied with reference to the efficiency of a proposed method of vessel propulsion using an underwater two-phase jet to determine whether the hot compressed gas expands adiabatically or whether there is significant heat transfer between the gas and liquid, causing a near isothermal expansion. Heat transfer rates from gas to liquid are inferred from measurements in bubble formation from unstable jets and from measurements of jet momentum in two-phase nozzle flow. The experimental results and the results of theoretical work show that the heat transfer is very fast. Coupled with thermodynamic considerations, the results imply that advantageous adiabatic expansion is unlikely to be achieved. Consideration of two-phase fluid mechanics and the results of the nozzle experiments suggest that efficiency benefits are more likely to be obtained by design for high momentum transfer. It is recommended that any future studies should be of the fluid dynamic aspects. Author (ESA)

N78-18374# Advisory Group for Aerospace Research and Development, Paris (France).

APPLICATIONS OF NON-INTRUSIVE INSTRUMENTATION IN FLUID FLOW RESEARCH

X. Bouis Dec. 1977 11 p ref In FRENCH Translation was announced as N77-11221
(AGARD-AR-112) Avail: NTIS HC A02/MF A01

A symposium was held to discuss and study in detail utilization techniques. Emphasis was placed on exact methods of flow measurement, and shorttime response applied to transonic, supersonic and hypersonic turbulent flows. Other topics of discussion were some of the following: (1) development stages of measuring techniques; (2) problems that these techniques can solve in external aerodynamics, turbomachinery, and flow with chemical reactions; (3) laser utilization; (4) Raman anti-Stokes diffusion; and (5) infrared emission and mathematical application of interferometry. Transl. by B.B.

N78-18375# Advisory Group for Aerospace Research and Development, Paris (France).

THREE DIMENSIONAL AND UNSTEADY SEPARATION AT HIGH REYNOLDS NUMBERS

Feb. 1978 248 p refs In ENGLISH and FRENCH Lecture held at Rhode-Saint-Genese, Belgium, 20-24 Feb 1978
(AGARD-LS-94; ISBN-92-835-0210-8) Avail: NTIS HC A11/MF A01

The present state of knowledge of three dimensional flows which contain regions of quasi-steady or unsteady separation is reviewed. Current methods for investigating such flows are critically appraised. Both experimental and theoretical aspects are considered with particular emphasis on the transonic regime. For individual titles, see N78-18376 through N78-18388.

N78-18376# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

PRESENTATION OF THE SUBJECT

M. Sirieix *In* AGARD Three Dimensional and Unsteady Separation at High Reynolds Numbers Feb. 1978 16 p refs In ENGLISH and FRENCH (For availability see N78-18375 09-34)
Avail: NTIS HC A11/MF A01

Lecture and round table topics introduced include: (1) progress made in the numerical solution of two dimensional separated flows and in understanding three dimensional separation; (2) the effects of separation in the design and performance prediction of missiles and aircraft; (3) physical aspects of unsteady separation; (4) inviscid fluid models for the computation of three dimensional separation at high Reynolds numbers; (5) the structure of turbulence in complex flows; and (6) numerical methods for separated flows. A.R.H.

N78-18377# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).

SEPARATION PROBLEMS ENCOUNTERED BY AIRCRAFT DESIGNERS CSS DIV. DES ETUDES AVANCEES. [LES PROBLEMES DE DECOLLEMENTS POSES A L'AVIONNEUR]

Pierre Perrier *In* AGARD Three Dimensional and Unsteady Separation at High Reynolds Numbers Feb. 1978 11 p refs In FRENCH (For availability see N78-18375 09-34)
Avail: NTIS HC A11/MF A01

The different ways in which flow separation presents problems to aircraft manufacturers in the design and performance prediction of civil and military aircraft are distinguished. The means used to resolve these problems are reviewed from an analytical and experimental viewpoint. Areas of research which show promise for reducing the adverse effects of quasi- and quasi-steady and unsteady separation are explored. A.R.H.

N78-18378# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

NUMERICAL SOLUTION OF VISCOUS-INVISCID INTERACTION PROBLEMS IN TWO-DIMENSIONAL COMPRESSIBLE FLOWS BASED ON THE NAVIER-STOKES EQUATIONS

Henri Viviand *In* AGARD Three Dimensional and Unsteady Separation at High Reynolds Numbers Feb. 1978 21 p refs In FRENCH; ENGLISH summary (For availability see N78-18375 09-34)
Avail: NTIS HC A11/MF A01

An approach based on the numerical solution of the Navier-Stokes equations for the treatment of viscous-inviscid interaction problems in two-dimensional high Reynolds number compressibe flows is reviewed. This global approach involves two distinct problems: on the one hand the numerical solution

of the equations used, and on the other hand turbulence modeling to close the system of the averaged equations for the case of compressible separated flows, the validity of turbulence models being tested through comparisons between numerical predictions and experimental results. A general presentation of the problems and of the results which have been obtained are presented with emphasis on the essential features of the numerical methods and of the turbulence models which have been used. Author

N78-18379# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
VISCID-INVISCID INTERACTION METHODS FOR TWO-DIMENSIONAL FLOWS, INCLUDING SEPARATION AND SHOCK WAVES
Jean-Claude LeBalleur *In* AGARD Three Dimensional and Unsteady Separation at High Reynolds Numbers Feb. 1978 24 p refs In FRENCH, ENGLISH summary (For availability see N78-18375 09-34)
Avail: NTIS HC A11/MF A01

Available methods for predicting viscous flows when the Reynolds number is high enough to justify approximation of the inviscid flow in a large part of the flow field are reviewed with respect to steady laminar or turbulent mean flows. The different approaches used to approximate the Navier-Stokes equations are: (1) rational asymptotic methods for both weak and singular boundary interactions; (2) truncated Navier-Stokes equations; (3) numerical matching at large distance of boundary layer regions; (4) viscid-inviscid patching according to the strong interaction of interacting boundary layer concept; and (5) simplified methods with empirical models of separation. Emphasis is given to progress achieved with the interacting boundary layer methods. Author

N78-18380*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PHENOMENOLOGICAL ASPECTS OF QUASI-STATIONARY CONTROLLED AND UNCONTROLLED THREE-DIMENSIONAL FLOW SEPARATIONS
David J. Peake *In* AGARD Three Dimensional and Unsteady Separation at High Reynolds Numbers Feb. 1978 52 p refs (For availability see N78-18375 09-34)
Avail: NTIS HC A11/MF A01 CSCL 20D

Interest in three dimensional flow separation is linked closely with wings of high leading edge sweep and bodies of fineness ratio operating at large angles of incidence or yaw, that are typical of many high-speed aircraft and missile layouts. The quasi-steady three dimensional separated flows about practical flight vehicles are discussed as well as the general character of the three dimensional attached boundary layer, the concept of limiting streamlines, and the present understanding of the physics of three dimensional separation and reattachment. The advantages of swept, sharp edges that generate controlled (or fixed) three dimensional flow separations on a vehicle because of the qualitatively unchanging flow field developed throughout the range of flight conditions are promoted in preference to allowing for uncontrolled (or unfixed) separations. Author

N78-18381*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INTRODUCTION TO UNSTEADY ASPECTS OF SEPARATION IN SUBSONIC AND TRANSONIC FLOW
W. J. McCroskey *In* AGARD Three Dimensional and Unsteady Separation at High Reynolds Numbers Feb. 1978 8 p refs (For availability see N78-18375 09-34)
Avail: NTIS HC A11/MF A01 CSCL 20D

Almost any flow that separates will have some degree of unsteadiness. In some cases, the fluctuations will be almost complete stochastic; in others it will be highly organized; and in still others, it will be a combination of random and periodic components. Some peculiar unsteady phenomena are reviewed and several classes of flow problems are discussed. Flow visualization and pressure measurements are used to explore external flows past fluff bodies, unsteady separation on slender bodies, and internal flows. A.R.H.

N78-18382# Royal Aircraft Establishment, Bedford (England).
PREDICTION OF THE SEVERITY OF BUFFETING
D. G. Mabey *In* AGARD Three Dimensional and Unsteady Separation at High Reynolds Numbers Feb. 1978 30 p refs (For availability see N78-18375 09-34)
Avail: NTIS HC A11/MF A01

The nature of buffeting, and buffeting criteria for fighter and transport aircraft are examined. Flow fields about unswept wings, swept wings, and slender wings are discussed. Although the onset of flow separations (the buffet boundary) can be predicted by a combination of boundary layer methods and potential flow theory, adequate theoretical methods are not yet available to predict the aerodynamic excitation after separation. The prediction of the severity of aircraft buffeting will continue to depend on model tests in wind tunnels. Three types of model tests are: (1) ordinary wind tunnel models used to measure unsteady wing-root strain in the first bending mode; (2) ordinary wind tunnel models used to measure the unsteady pressure across the appropriate surface; and (3) aeroelastic models used to measure unsteady responses. The importance of using wind tunnels with low levels of flow unsteadiness is emphasized. Alternative methods of determining buffeting onset are discussed. A.R.H.

N78-18383*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SOME UNSTEADY SEPARATION PROBLEMS FOR SLENDER BODIES
W. J. McCroskey *In* AGARD Three Dimensional and Unsteady Separation at High Reynolds Numbers Feb. 1978 11 p refs (For availability see N78-18375 09-34)
Avail: NTIS HC A11/MF A01 CSCL 20D

The development of reliable prediction techniques for engineering purposes requires a fundamental and detailed understanding of the unsteady flow fields on wings and rotating blades. Some of the peculiar features of unsteady separated flows that are not simple analogs or extensions of quasi-steady flows are discussed. These include: the unsteady Kutta-Joukowski condition, dynamic stall on oscillating airfoils (with applications to helicopter rotor blades) and unsteady shock wave-boundary layer interaction. Author

N78-18384# Royal Aircraft Establishment, Farnborough (England). Dept. of Aerodynamics.
INVISCID FLUID MODELS, BASED ON ROLLED-UP VORTEX SHEETS, FOR THREE-DIMENSIONAL SEPARATION AT HIGH REYNOLDS NUMBER
J. H. B. Smith *In* AGARD Three Dimensional and Unsteady Separation at High Reynolds Numbers Feb. 1978 27 p refs (For availability see N78-18375 09-34)
Avail: NTIS HC A11/MF A01

The inviscid fluid models which have been used to represent flows with three dimensional separations of vortex type are introduced and described. Their strengths and weaknesses are discussed, and suggestions are made for improvements. A selection of results for a wide range of problems is presented. The difficulties which arise in trying to extend these models to represent separation from highly swept separation lines on smooth bodies are explored and a view is given of the present position and developments in the immediate future. Author

N78-18385# Imperial Coll. of Science and Technology, London (England).
STRUCTURE OF TURBULENCE IN COMPLEX FLOWS
P. Bradshaw *In* AGARD Three Dimensional and Unsteady Separation at High Reynolds Numbers Feb. 1978 7 p refs (For availability see N78-18375 09-34)
Avail: NTIS HC A11/MF A01

Unsteadiness and three-dimensionality do not constitute complexities in themselves but allow more opportunities for interaction or distortion to occur. In nearly all cases the turbulent flow is dominated by a shear layer because it is, as a rule, only in shear layers that large Reynolds-stress gradients can arise. The effects of unsteadiness or three-dimensionality on turbulence and turbulence models (empirical equations for Reynolds stress) are discussed. The response of shear layers to extra rates of strain are outlined and the concept of the fairly thin shear layer, in which terms that are neglected in the thin-shear layer equations are retained but approximated, is presented. The special problems of separated flow are briefly reviewed. Author

N78-18386# Imperial Coll. of Science and Technology, London (England).

PREDICTION OF SEPARATION USING BOUNDARY LAYER THEORY

P. Bradshaw *In* AGARD Three Dimensional and Unsteady Separation at High Reynolds Numbers Feb. 1978 8 p refs (For availability see N78-18375 09-34)
Avail: NTIS HC A11/MF A01

An experimental surface pressure distribution for a separating flow almost always shows an abrupt decrease in adverse pressure gradient at the separation point - because of the sudden increase in d delta/dx - so that the position of separation can be found quite accurately by inspection. Carrying out a boundary layer calculation for such a flow, taking the pressure distribution as known, is therefore of no practical value. Especially in separating flow, practical problems involve the matching of a shear-layer calculation to that of an inviscid outer flow. One part of this process is the solution of equations for the shear layer (e.g. boundary layer and wake) with a pressure distribution at the shear-layer edge derived from the inviscid solution. This is the problem addressed in this section. Calculation of the boundary layer up to a short distance from separation is straightforward in principle. The presence or otherwise of a singularity at separation and calculation methods for reversed flow are considered.Author

N78-18387*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

PREDICTION OF UNSTEADY SEPARATED FLOWS ON OSCILLATING AIRFOILS

W. J. McCroskey *In* AGARD Three Dimensional and Unsteady Separation at High Reynolds Numbers Feb. 1978 8 p refs (For availability see N78-18375 09-34)
Avail: NTIS HC A11/MF A01 CSCL 20D

Calculating the flow around an airfoil undergoing dynamic stall is a task which has not yet been accomplished at high Reynolds numbers, although several approximate analytical methods have been proposed. The most promising of those methods seems to be either a combination of the discrete potential vortex and thin boundary layer approaches, or a significantly improved version of the strong viscous-inviscid interaction approach. The former may prove to be superior for low speed, high amplitude flows, but the latter seems likely to be more suitable for airfoils that operate under supercritical transonic flow conditions and for cases that do not penetrate deeply into stall. At the present time, the engineer who is faced with the need to predict the aerodynamic forces and moments on oscillating airfoils would be better advised to turn to one of the empirical correlation techniques, or perhaps to utilize more than one method and average the results. In any event, these methods permit the essential features of dynamic stall to be described, even though further improvements are highly desirable. Future efforts will probably see more use made of the two-dimensional theoretical analyses, while experiments can be expected to play the major role in assessing the importance of the three-dimensional effects that are likely to be encountered in practice. Author

N78-18388*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

STATUS AND FUTURE PROSPECTS OF USING NUMERICAL METHODS TO STUDY COMPLEX FLOWS AT HIGH REYNOLDS NUMBERS

Robert W. McCormack *In* AGARD Three Dimensional and Unsteady Separation at High Reynolds Numbers Feb. 1978 14 p refs (For availability see N78-18375 09-34)
Avail: NTIS HC A11/MF A01 CSCL 20D

The Navier-Stokes equations adequately describe aerodynamic flows at standard atmospheric temperatures and pressures. If these equations could be efficiently solved, there would be no need for experimental tests to design flight vehicles or other aerodynamic devices. Although much progress has been made toward the solution, including complex unsteady two-dimensional and steady three-dimensional separated flows and have recently made some dramatic improvements in developing numerical methods, the calculation of flow fields past complete aircraft configurations at flight Reynolds numbers are far beyond our reach, perhaps as long as a decade away. They await substantial progress in devising accurate and efficient numerical methods, in understanding and modeling the physics of turbulence, and in developing reliable and powerful computer hardware.
Author

N78-18233# Polish Academy of Sciences, Warsaw.

EQUATIONS OF STEADY FLOW THROUGH SLIGHTLY CURVED MULTIFILAMENT BUNDLES

A. Szaniawski *In its* Arch. of Mech., Vol. 29, Issue 4 1977 p 519-530 refs (For availability see N78-18231 09-31)
Copyright. Avail: Issuing Activity

N78-18238# Polish Academy of Sciences, Warsaw.

COUPLING OF DISSIPATIVE MECHANISMS OF VISCOPLASTIC FLOW

P. Perzyna *In its* Arch. of Mech., Vol. 29, Issue 4 1977 p 607-624 refs Presented at the 14th IUTAM Congr., Delft, Netherlands, 30 Aug. - 4 Sep. 1976 (For availability see N78-18231 09-31)
Copyright. Avail: Issuing Activity

N78-18242 East Anglia Univ., Norwich (England). School of Mathematics and Physics.

RESTRICTIONS ON HEAT CONDUCTION IN SIMPLE MATERIALS

P. Chadwick *In* Polish Acad. of Sci. Arch. of Mech., Vol 29, Issue 5 1977 p 653-658 refs (For availability see N78-18240 09-31)
Copyright. Avail: Issuing Activity

N78-18249 Freiburg Univ. (West Germany). Inst. of Applied Mathematics.

THE EXISTENCE OF INSTATIONARY FLOWS IN INCOMPRESSIBLE MICROPOLAR FLUIDS

H. Lange *In* Polish Acad. of Sci. Arch. of Mech., Vol. 29, Issue 5 1977 p 741-744 refs (For availability see N78-18240 09-31)
Copyright. Avail: Issuing Activity

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N78-18389 Arizona Univ., Tucson.

DESIGNING HOLOGRAPHIC OPTICAL ELEMENTS Ph.D. Thesis

William Charles Sweatt 1977 111 p
Avail: Univ. Microfilms Order No. 77-29344

New method of designing and constructing holographic optical elements (HOE) are presented. An exact lens analog allows HOE's to be designed as lenses using standard lens design codes. The lens analog has a huge index of refraction and very small curvatures. Thick reflecting and transmitting HOE's will have better quality and efficiency if they are constructed with spherically aberrated wavefronts. The reconstruction wavelength is allowed to differ from the construction wavelength. The index of refraction and thickness of the emulsion may also change. Dissert. Abstr.

N78-18390* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

SEMICONDUCTOR PROJECTILE IMPACT DETECTOR Patent

Edward L. Shriver, inventor (to NASA) Issued 25 Oct. 1977 4 p Filed 11 Mar. 1976 Supersedes N76-19405 (14 - 10, p 1252)
(NASA-Case-MFS-23008-1; US-Patent-4,055,089;
US-Patent-Appl-SN-665734; US-Patent-Class-73-432R;
US-Patent-Class-73-28; US-Patent-Class-73-432PS;
US-Patent-Class-73-DIG.11) Avail: US Patent Office CSCL 14B

A semiconductor projectile impact detector is described for use in determining micrometeorite presence, as well as its flux and energy comprising a photovoltaic cell which generates a voltage according to the light and heat emitted by the mi-

crometeorites upon imact. A counter and peak amplitude measuring device were used to indicate the number of particules which strike the surface of the cell as well as the kinetic energy of each of the particles.
Official Gazette of the U.S. Patent Office

N78-18391* National Aeronautics and Space Administration. Pasadena Office, Calif.
INTERFEROMETER MIRROR TILT CORRECTING SYSTEM Patent
Rudolf A. Schindler, inventor (to NASA) (JPL) Issued 11 Oct. 1977 8 p Filed 18 Dec. 1975 Supersedes N76-14433 (14 - 05, p 0581) Sponsored by NASA
(NASA-Case-NPO-13687-1; US-Patent-4,053,231; US-Patent-Appl-SN-641803; US-Patent-Class-356-106S; US-Patent-Class-356-110) Avail: US Patent Office CSCL 14B

An interferometer is described, having several means for automatically adjusting the angular tilt of a reflecting surface in one of two paths to maintain the exit beams from the two paths parallel to each other. Three detectors at the output of the interferometer were disposed on mutually perpendicular axes which define a plane normal to the nominal exit beam axis. One detector at the origin of the axes was used as a reference for separate phase difference comparison with the outputs of the other two detectors on the X and Y axes to develop servo error signals. Official Gazette of the U.S. Patent Office

N78-18392# National Aeronautics and Space Administration, Washington, D. C.
RESISTANCE STRAIN GAGES FOR STABILITY EXPERIMENTS AT TEMPERATURES UP TO 300 DEG C
N. P. Klokova, L. T. Ivanova, L. N. Kamentseva, and Z. G. Gorkina Feb. 1978 9 p refs Transl. into ENGLISH from Tepl. Napryazh. v Elementakh Konstruktsii (USSR), no. 17, 1977 p 111-114 Original language document was announced as A77-36650
(NASA-TM-75246) Avail: NTIS HC A02/MF A01 CSCL 14B

The paper presents results of performance tests of resistance strain gages, designed for the fatigue testing and large strain testing of aircraft structures at temperatures up to 300 C. Constantan wires were used as sensitive grids in the gages, and thermally stable polymers were used as binder materials.
Author

N78-18393*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
ATTACHING OF STRAIN GAGES TO SUBSTRATES Patent Application
Meyer M. Lemcoe (Battelle Columbus Labs, Ohio) and Harry E. Pattee, inventors (to NASA) (Battelle Columbus Labs, Ohio) Filed 16 Feb. 1978 10 p
(Contract NAS4-2020)
(NASA-Case-FRC-10093-1; US-Patent-Appl-SN-878539) Avail: NTIS HC A02/MF A01 CSCL 14B

A method and apparatus for attaching strain gages to substrates was developed which is especially useful for field installation, and especially for materials which experience a drastic reduction in fatigue strength when heated as in spot welding. A strain gage having a backing plate is attached to a substrate by using a foil of brazing material between the backing plate and substrate. A pair of electrodes that are connected to a current source, are applied to opposite sides of backing plate, so that heating of the structure occurs primarily along the relatively highly conductive foil of brazing material. Field installations are facilitated by utilizing a backing plate with wings extending at an upward incline from either sider of the backing plate, by attaching the electrodes to the wings to perform the brazing operation, and by breaking off the wings after the brazing is completed. NASA

N78-18394*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SOLAR CELL ANGULAR POSITION TRANSDUCER Patent Application
Maynard C. Sandford and David L. Gray, inventors (to NASA) Filed 9 Feb. 1978 18 p
(NASA-Case-LAR-11999-1; US-Patent-Appl-SN-876299) Avail: NTIS HC A02/MF A01 CSCL 14B

A device that can accurately ascertain the angular position of an object was developed. It has been used to determine the position of control surfaces of a wind tunnel scaled model airplane. The angular position transducer uses a light source directed toward two photo cells. A control surface shaft is rotated from a zero null position and one solar cell receives more illumination than the other, producing a differential voltage between the two cells. This voltage is directly proportional to the shaft rotational angle. The voltage is amplified by a high gain surface angular position.
NASA

N78-18395*# National Aeronautics and Space Administration. Pasadena Office, Calif.
OVER-UNDER DOUBLE-PASS INTERFEROMETER Patent Application
Rudolf A. Schindler, inventor (to NASA) (JPL) Filed 8 Dec. 1977 12 p
(Contract NAS7-100)
(NASA-Case-NPO-13999-1; US-Patent-Appl-SN-858596) Avail: NTIS HC A02/MF A01 CSCL 14B

An over-under double pass interferometer in which the beamsplitter area and thickness can be reduced to conform only with optical flatness considerations was achieved by offsetting the optical center line of one cat's-eye retroreflector relative to the optical center line of the other in order that one split beam be folded into a plane distinct from the other folded split beam. The beamsplitter is made transparent in one area for a first folded beam to be passed to a mirror for doubling back and is made totally reflective in another area for the second folded beam to be reflected to a mirror for doubling back. The two beams thus doubled back are combined in the central, beamsplitting area of the beamsplitting and passed to a detector. This makes the beamsplitter insensitive to minimum thickness requirements and selection of material. NASA

N78-18396*# National Aeronautics and Space Administration. Pasadena Office, Calif.
A SYSTEM AND METHOD FOR OBTAINING WIDE SCREEN SCHLIEREN PHOTOGRAPHS Patent Application
Shakkottai P. Parthasarathy, inventor (to NASA) (JPL) Filed 9 Feb. 1978 10 p
(Contract NAS7-100)
(NASA-Case-NPO-14174-1; US-Patent-Appl-SN-876441) Avail: NTIS HC A01/MF A01 CSCL 14E

A system and method are presented for obtaining wide screen schlieren photographs by imaging a first optical grating against a large grating to form a moire pattern as a background. The invention is embodied in a system including a screen, a large grating adjacently related to the screen, a small grating disposed in spaced relation with the large grating, a transparent retainer for confining a fluid medium between the gratings, and optics for imaging the small grating on the large grating including a light source and on optically aligned lens for projecting a beam of light along an axis extending through the small grating and striking the large grating, subsequent to passing through the medium, for thus forming on the screen a schlieren image consisting of striations resulting from distortions of light rays produced by the medium, and a camera for photographing the schlieren image. NASA

N78-18397# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
NONDESTRUCTIBLE MESG PROGRAM Final Report, Jul. 1974 - Jun. 1977
K. Taylor Wright-Patterson AFB, Ohio AFAL Aug. 1977 55 p refs
(Contract F33615-74-C-1234; AF Proj. 666A)
(AD-A048191; R-1089; AFAL-TR-77-159) Avail: NTIS HC A04/MF A01 CSCL 13/8

A program was carried out to develop suitable surface hard-coatings to render MESG bearing hardware indestructible. A test program to determine friction and wear characteristics of carbide-type materials in the MESG environments was carried out and a carboloy-type coating of WC-Co was selected for the final cavity surface, and a thin film of molybdenum sulfide was selected for the rotor surface. Tests were also carried out to determine other coating properties such as magnetic susceptibility, electrical resistivity and adhesion. Suitable coating procedures based on vacuum deposition techniques such as sputtering and

electron beam evaporation were also developed and successfully used to coat both specimens for tests and final MESG cavity and rotor parts. A total of eight MESG rotors were successfully coated with molybdenum disulfide approximately 0.20 microns thick and six sets of cavity parts were coated with an intermediate layer of Inconel by substrate biased high-tate-electron beam evaporation (Ion-plated) and a final layer of WC-Co by hollow cathode-type planar magnetron sputtering. These parts were then delivered to the Autonetics Division of Rockwell International Corporation for testing. Author (GRA)

N78-18398# Signetics Corp., Sunnyvale, Calif.
CANTILEVER ACCELEROMETER Final Report, Jul. 1975 - Aug. 1977
Warren C. Rosvold and Mark L. Stephens Sep. 1977 86 p refs
(Contract F33615-76-C-1159)
(AD-A048045; AFAL-TR-77-152) Avail: NTIS HC A05/MF A01 CSCL 14/2

Four accelerometer models were designed, manufactured and evaluated during the term of the contract. These were built using single crystalline silicon and integrated circuit fabrication techniques. The basic physical structure used on all accelerometer models was the 'H' geometry. The difference between the models was the topographical locations of the piezoresistor bridge, and electronic components which were adjusted in order to obtain optimized accelerometer performance. Author (GRA)

N78-18399# Carson Alexiou Corp., Norwalk, Conn.
ELECTRON BEAM RECORDER APPLICATIONS STUDY Contractor Report, Apr. - Aug. 1977
James J. Greed, Jr. and Gerald N. Wallmark Aug. 1977 113 p refs
(Contract DAAK70-77-C-0111)
(AD-A048666; FF-12; ETL-0120) Avail: NTIS HC A06/MF A01 CSCL 14/3

Electron Beam Recording (EBR) was studied in the context of its potential uses in the Defense Mapping Agency. It was found to have applications in cartographic recording, textual recording, and microfiche preparation. The making of pressplates from EBR masters involves the use of optical projection systems and 'projection speed' materials. The properties of several such materials were found to be suitable. Non-cartographic users were also found, including the potential for exploitation of the very high resolution available from an EBR for mass memory applications. Author (GRA)

N78-18400# Andros, Inc., Berkeley, Calif.
A SENSOR FOR THE DETECTION OF CO2 IN HYPERBARIC GASEOUS ENVIRONMENTS Final Report
Kevin G. Williams Nov. 1977 42 p
(Contract N00014-74-C-0240)
(AD-A048599; ARFR-105) Avail: NTIS HC A03/MF A01 CSCL 14/2

The characteristics of the essential components of a Nondispersive Infrared (NDIR) gas sensor for measuring CO2 concentrations in hyperbaric gaseous environments have been studied. The technique used is to subject a known volume of sample gas to a periodic density modulation and to measure the amount of CO2 present by observing the fractional change in a beam of infrared radiation transmitted through that volume. A sensor that uses this technique has been built for use in habitats at pressures up to 600 psia. It measures 8 x 7 x 14 inches and operates directly from 28 volts dc. The sensor's response is not strongly pressure dependent (the maximum deviation from the response at 14.7 psia being only 18% of reading). Neither re-zeroing nor recalibration are necessary since the design inherently maintains both. 0 to 90% response is about 40 seconds for both increasing and decreasing pCO2.
Author (GRA)

N78-18401# Harris Corp., Melbourne, Fla. Electronic Systems Div.
WIDEBAND HOLOGRAPHIC DIGITAL RECORDING AND REPRODUCTION Executive Summary, Jan. 1973 - Nov. 1976
Andrew M. Bardos, George S. Moore, Richard H. Nelson, Lynda M. Ralston, and Michael W. Shareck Apr. 1977 33 p refs
(Contract F30601-73-C-0155; ARPA Order 2322)
(AD-A048464; RADC-TR-77-153) Avail: NTIS HC A03/MF A01 CSCL 14/3

Techniques were investigated to apply the concept of holography to the problems of wideband digital recording and reproduction. The feasibility of recording at rates up to 2 Gb/s and playback at both full-record and reduced speeds was theoretically and experimentally considered. The program was a multi-phased effort including the design, development and experimental evaluation of two Exploratory Development Models (EDMs): the Phase I EDM demonstrated recording at 400 Mb/s and playback at 40 Mb/s, and was used to guide design trade-offs for Phase II; the Phase II EDM demonstrated recording at 600 Mb/s playback at full-record and 0 to 1 time expanded rates with bit-error-rates better than .000001. Both full-system operational testing and parametric evaluation on component basis were performed. This report describes design and performance data at both the system and the subsystem levels for the Phase II hardware. Also a part of this program was the development of conceptual designs for potential multi-gigabit recorders. These designs are presented, along with system and subsystem level trade-offs between the various concepts, and recommendations for subsequent development. Overall, this program has made available a new, high-speed, high-capacity information storage approach offering significant advantages over more conventional recording techniques. Author (GRA)

N78-18402# National Bureau of Standards, Boulder, Colo. Electromagnetics Div.
NBS TYPE 4 RF POWER METER OPERATION AND MAINTENANCE
Neil T. Larsen Oct. 1977 39 p
(PB-274456/3; NBSIR-77-866) Avail: NTIS HC A03/MF A01 CSCL 14B

Operating, maintenance, and calibration procedures are provided for the NBS Type IV power meter a recently developed instrument for RF power measurement by means of dc substitution in a bolometer (thermistor type only). Complete parts lists, schematic diagrams, and parts placement drawings were provided. GRA

N78-18403# Sandia Labs., Albuquerque, N. Mex. Applied Technology Div.
MICROCHANNEL PLATE RESPONSE TO HARD X-RAYS
K. W. Dolan and J. Chang Mar. 1977 14 p refs Presented at Soc. Photo-Opt. Instrumentation Engr. X-ray Imaging Symp., Reston, Va., 18-21 Apr. 1977 Submitted for the publication
(Contract EY-76-C-04-0789)
(SAND-77-8621; Conf-770434-4) Avail: NTIS HC A02/MF A01

The current response and the pulse response of a microchannel plate, MCP, to X-rays incident at an angle of 45 deg in the energy range of 8 to 100 keV were measured. The X-ray detection efficiency, pulse height distributions, and sensitive depth of the MCP were determined from these data. Detection efficiency extrapolates to zero below 8 keV, and ranges between values of 1% and 2.6% above this energy, much higher than anticipated from previous measurements for oblique incidence below 6 keV. When compared to previous measurements at higher energies, it was concluded that MCP's have a relatively constant detection efficiency in the energy range 10 to 600 keV, which was a rather unique property as compared to other X-ray detectors. It was found that the shape of current response curves differs somewhat from the shape of efficiency curves, that pulse height distributions were proportional to pulse height to the -1.1 to -1.6 power, and that 90% of the current originated in the first 25 to 30% of the MCP thickness. ERA

N78-18404# Los Alamos Scientific Lab., N. Mex.
IMAGE RESTORATIONS CONSTRAINED BY A MULTIPLY EXPOSED PICTURE
J. R. Breedlove, Jr., R. P. Kruger, H. J. Trussell, and B. R. Hunt (Ariz. Univ., Tucson) 1977 7 p Presented at Intern. Opt. Computing Conf., San Diego, Calif., 25 Aug. 1977 Submitted for publication
(Contract W-7405-eng-36)
(LA-UR-77-1790; Conf-770844-3) Avail: NTIS HC A02/MF A01

There are a number of possible industrial and scientific applications of nanosecond cineradiographs. While the technology exists to produce closely spaced pulses of X-rays for this application, the quality of the time-resolved radiographs is severely limited. The limitations arise from the necessity of using a fluorescent screen to convert the transmitted X-rays to light and then using electro-optical imaging systems to gate and to record the images with conventional high-speed cameras. It was proposed that in addition to the time-resolved images, a conventional multiply-exposed radiograph be obtained. Simulations were used to demonstrate that the additional information supplied by the multiply-exposed radiograph can be used to improve the quality of digital image restorations of the time-resolved pictures over what could be achieved with the degraded images alone. ERA

N78-18405# Commissariat a l'Energie Atomique, Grenoble (France). Lab. d'Electronique Physique Appliquee.
PRELIMINARY STUDY OF A DATA RECORDER WITH A MAGNETIC BUBBLE MEMORY Final Report [ETUDE PRELIMINAIRE D'UN ENREGISTREUR DE DONNEES EQUIPE D'UNE MEMOIRE A BULLES MAGNETIQUES]
P. Coeure, J. Daval, H. Jouve, M. Saro, and D. Mauduit Paris ESA 13 Oct. 1977 118 p In FRENCH
(Contract ESTEC-2569/75-HP-SC)
(LETI/EPA/CRM-1248; ESA-CR(P)-1013) Avail: NTIS HC A06/MF A01

A feasibility study of a magnetic bubble memory module for space applications is reported. All technological aspects were considered: manufacturing of a garnet allowing the memory to operate between -25 and +60 C and capable of carrying bubbles with diameters between 6 and 2.5 microns; realization of memory chips of 1 kbits and 4 kbits; demonstration of the module's operation at a frequency of 100 kHz of the rotating field; stop-start operation and nonvolatility of the information; and a proposal for a new packaging consisting of a case with 4 chips and having a capacity between 256 kbits (4 chips of 64 k) and 1 Mbits (4 chips of 256 k). ESA

N78-18406# National Physical Lab., Teddington (England). Div. of Quantum Metrology.
NOTES ON DESIGN OF HIGH EFFICIENCY BEAM DIVIDERS FOR TWO BEAM INFRA-RED INTERFEROMETERS
R. H. Bradsell Nov. 1977 17 p refs
(NPL-QU-41) Avail: NTIS HC A02/MF A01

Two design approaches are described, and the theory developed, for the production of a beam splitter for the NPL selective interferometer filter. One approach is based on dielectric multi-layers and the other on a pellicle of dielectric material. Author (ESA)

N78-18407# National Physical Lab., Teddington (England). Div. of Quantum Metrology.
RESISTANCE RATIO/TEMPERATURE RELATIONSHIPS FOR INDUSTRIAL PLATINUM RESISTANCE THERMOMETERS OF THICK FILM CONSTRUCTION
M. V. Chattle Oct. 1977 15 p refs
(NPL-QU-42) Avail: NTIS HC A02/MF A01

A previous NPL Report (Qu 30, November 1975) gave the results of the examination of industrial platinum resistance thermometers of conventional wire-wound designs and proposed a new resistance ratio temperature relationship. Increasing use is now being made of platinum resistance thermometers of thick-film construction, and the results obtained from tests carried out on two types of U.K.-manufactured thermometers are outlined. Results indicate that thermometers of this construction are capable of satisfying present-day tolerances (e.g., Grade I of BS 1904 : 1964), although they are slightly better matched to the resistance ratio/temperature relationship proposed in Qu 30 than to that used in BS 1904. Author (ESA)

N78-18408# European Space Agency, Paris (France).
THE USE OF PYRANOMETERS IN AIRCRAFT
Hans P. Fimpel Dec. 1977 54 p refs Transl. into ENGLISH of 'Die Verwendung von Pyranometern in Flugzeugen', DFVLR, Oberpfaffenhofen, West Ger. Report DLR-FB-77-24, 3 Jun. 1977 Original report in GERMAN previously announced as N78-14379 Original German report available from DFVLR, Cologne DM 18.50
(ESA-TT-433; DLR-FB-77-24) Avail: NTIS HC A04/MF A01

The Moll-Gorczynski-Solarimeter and the Eppley-Pyranometer Model PSP were investigated in order to find out whether they can be used for measurements onboard aircraft. The influence of temperature and pressure on the sensitivity, the dependence of the inclination, and the heating through high air-velocities were studied in laboratory and ground-based measurements. Measurements with an aircraft showed that the influence of quick variations of the air temperature can be easily corrected. Author (ESA)

N78-19028*# Societe Matra (France).
SCANNING AND FOCUSING MECHANISMS OF METEOSAT RADIOMETER
J. Jouan *In* NASA. Goddard Res. Center The 11th Aerospace Mech. Symp. Apr. 1977 p 13-22 (For availability see N78-19026 09-99)
Avail: NTIS HC A11/MF A01 CSCL 14B

N78-19031*# Teldix Luftfahrt-Ausruestungs G.m.b.H., Heidelberg (West Germany).
MAGNETIC BEARING MOMENTUM WHEELS WITH MAGNETIC GIMBALLING CAPABILITY FOR 3-AXIS ACTIVE ATTITUDE CONTROL AND ENERGY STORAGE
Rainer S. Sindlinger *In* NASA. Goddard Res. Center The 11th Aerospace Mech. Symp. Apr. 1977 p 45-55 refs (For availability see N78-19026 09-99)
Avail: NTIS HC A11/MF A01 CSCL 14B

36 LASERS AND MASERS

Includes parametric amplifiers.

N78-18409 Florida Univ., Gainesville.
ATOMIC FLUORESCENCE FLAME SPECTROMETRY WITH A CONTINUOUS WAVE DYE LASER Ph.D. Thesis
Benjamin Willard Smith 1977 71 p
Avail: Univ. Microfilms Order No. 77-25956

The tunable continuous wave (CW) dye laser was shown to be capable of producing saturation conditions for sodium in an air - acetylene flame. The experimental evidence indicated that the sodium doublet was a reasonably good approximation of a two-level system. Measurements of the absolute maximum fluorescence radiance under saturation conditions were used to measure sodium concentration profiles in air - hydrogen and air - acetylene flames with spatial resolution on the order of 0.01 cm. The cw dye laser was used as an atomic fluorescence excitation source for analytical purposes and, using resonance fluorescence, limits of detection of 0.0001 (micron)(g)(ml to the -1 power) were obtained for sodium and barium, respectively. Dissert. Abstr.

N78-18410* National Aeronautics and Space Administration. Pasadena Office, Calif.
INDEPENDENT GAIN AND BANDWIDTH CONTROL OF A TRAVELING WAVE MASER Patent
David L. Trowbridge, inventor (to NASA) (JPL) Issued 25 Oct. 1977 7 p Filed 26 Jul. 1976 Supersedes N76-31514 (14 - 22, p 2870) Sponsored by NASA
(NASA-Case-NPO-13801-1; US-Patent-4,055,810;
US-Patent-Appl-SN-708796; US-Patent-Class-330-4;
US-Patent-Class-332-7.5) Avail: US Patent Office CSCL 20E

An X-band traveling wave maser of the folded-comb type is presented, with two figure-eight coils for gain and bandwidth control. One figure-eight coil covers the full lengths of the comb structure for bandwidth adjustment of an external magnetic field. The other coil covers a central half of the comb structure for independent gain adjustment of the external magnetic field. The half of each figure-eight coil at the turn around end of the comb structure is oriented to aid the external magnetic field, and the half of each coil at the input-output end of the comb structure is oriented to buck the external magnetic field. The maser is pumped in the push-push mode with two different frequencies. Official Gazette of the U.S. Patent Office

N78-18411*# Avco-Everett Research Lab., Everett, Mass.
LASER ABSORPTION PHENOMENA IN FLOWING GAS DEVICES Final Technical Report
P. K. Chapman and J. H. Otis Jun. 1976 125 p refs
(Contract NAS3-18559)
(NASA-CR-135129) Avail: NTIS HC A06/MF A01 CSCL 20E

A theoretical and experimental investigation is presented of inverse Bremsstrahlung absorption of CW CO2 laser radiation in flowing gases seeded with alkali metals. In order to motivate this development, some simple models are described of several space missions which could use laser powered rocket vehicles. Design considerations are given for a test call to be used with a welding laser, using a diamond window for admission of laser radiation at power levels in excess of 10 kW. A detailed analysis of absorption conditions in the test cell is included. The experimental apparatus and test setup are described and the results of experiments presented. Injection of alkali seedant and steady state absorption of the laser radiation were successfully demonstrated, but problems with the durability of the diamond windows at higher powers prevented operation of the test cell as an effective laser powered thruster. Author

N78-18412# SRI International Corp., Arlington, Va.
JASON LASER PROPULSION STUDY, SUMMER 1977
F. J. Dyson and F. W. Perkins, Jr. Dec. 1977 31 p refs
(Contract DAHC15-73-C-0370)
(AD-A047901; SRI-JSR-77-12) Avail: NTIS HC A03/MF A01 CSCL 21/3

Laser propulsion is an idea that may produce a revolution in space technology. A single laser facility on the ground can in theory launch single-stage vehicles into low or high earth orbit. The payload can be 20% or 30% of the vehicle take-off weight. It is far more economical in the use of mass and energy than chemical propulsion, and it is far more flexible in putting identical vehicles into a variety of orbits. Author (GRA)

N78-18413# Princeton Univ., N. J. Dept. of Chemistry.
COLLISION STUDIES OF GASEOUS MOLECULAR LASERS
Herschel Rabitz Dec. 1977 5 p refs
(Contract N00014-75-C-0478)
(AD-A048010; PR-6) Avail: NTIS HC A02/MF A01 CSCL 20/5

Molecular collision research at Princeton is reviewed. The topics covered are: Inversion of Spectral Line Shapes, Chemical Reaction Dynamics, Stochastic Theory of Intra- and Intermolecular Energy Transfer, Effective Hamiltonian Theory, CO-He Electric Discharges, and Vibration-Rotation Relaxation. GRA

N78-18414# North Texas State Univ., Denton. Dept. of Physics.
INVESTIGATION OF LASER OPTICAL BIASING ON THE QUANTUM TRANSPORT PROPERTIES OF n-InSb Annual Summary Report, 1 Oct. 1976 - 30 Sept. 1977
David G. Seiler Oct. 1977 73 p refs
(Contract N00014-76-C-0319)
(AD-A048229) Avail: NTIS HC A04/MF A01 CSCL 20/5

CO2 laser induced hot electrons in n-InSb have been studied at liquid helium temperatures by determining the effect of the laser radiation on the amplitude of Shubnikov-de Haas oscillations. A new technique for investigating hot electron oscillatory magnetoresistance has been utilized in obtaining fundamental information concerning the effects of CO2 laser radiation and high electric fields on the quantum transport properties of n-InSb. GRA

N78-18415# Naval Postgraduate School, Monterey, Calif.
AERODYNAMIC STABILIZATION OF GASEOUS DISCHARGES Final Report, 1 Oct. 1976 - 30 Aug. 1977
Oscar Biblarz 1 Nov. 1977 30 p refs
(AD-A048533; NPS-67BI77111) Avail: NTIS HC A03/MF A01 CSCL 20/5

This report covers some aspects of the formulation of the stabilization problem by aerodynamic means. Results of experimental work are not included but are referred to in appropriate places. The classical solution for ambipolar diffusion in the positive column of the glow discharge must be extended to reflect the influence of current and pressure. The influence of current is given by the inclusion of appropriate energy equations and the pressure influence by the addition of two-body recombination. It was found that, from dimensional analysis, the characteristic lengths for ambipolar and heat diffusion for helium do not match. A re-formulation of the problem is thus necessary. The recombination term does not change the eigenvalue nature of the diffusion equation except at the stationary or local equilibrium limit. Author (GRA)

N78-18416# Litton Systems, Inc., Reseda, Calif. Airtron Div.
MANUFACTURING METHODS AND TECHNOLOGY ENGINEERING FOR NEODYMIUM DOPED YAG LASER RODS Quarterly Progress Report, 1 Jun. - 31 Aug. 1977
D. Dentz Oct. 1977 24 p
(Contract DAAB07-77-C-0375)
(AD-A048662; QPR-2) Avail: NTIS HC A02/MF A01 CSCL 20/5

The polishing fixture designed to hold sixteen rods during fabrication was received during this quarter. Using this fixture several lots of rods were processed to evaluate the proposed polishing process. Process data, times and yields were obtained. Rods were measured for adherence to specifications and data collected as a function of rod position with the block. Author (GRA)

N78-18417# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Electrical Engineering and Applied Physics.
PARAMETER STUDIES RELATIVE TO AN ELECTRIC FIELD-INDUCED DIPOLE MOMENT LASER Final Report, 1 Apr. 1976 - 31 Jul. 1977
Paul C. Claspy 17 Nov. 1977 36 p refs
(Contract DAAG29-76-G-0189)
(AD-A048327; ARO-13807.1-PX) Avail: NTIS HC A03/MF A01 CSCL 20/5

A high pressure optoacoustic cell has been calibrated over the pressure range from 5 to 35 atm using the pressure-induced absorption in N2. Attempts to measure electric field-induced absorption in N2 near 4.4 micrometers using a carbon arc source have been unsuccessful because of insufficient spectral power density. Author (GRA)

N78-18418# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
EFFECTS OF GAMMA RADIATION ON GALLIUM-ARSENIDE LASERS M.S. Thesis
Harro Ackermann Dec. 1977 64 p refs
(AD-A048361; AFIT-GEP/PH/77-1) Avail: NTIS HC A04/MF A01 CSCL 18/8

The effect of gamma radiation from a Co60 source on the performance of two types of aluminum gallium arsenide injection lasers was investigated. Both types of lasers were designed to operate in the continuous wave mode at room temperature. Measurements were conducted to determine radiation induced changes in the threshold current, power output, efficiency, and spectral and intensity distributions. Damage factors were calculated by the constant voltage and constant current methods. Type C30127 (RCA) exhibited rapid degradation. A dosage of 10000 Rad(Si) reduced the output power by a factor of two. Threshold current increased, efficiency decreased, and the intensity distribution changed drastically. The damage factor at constant voltage was calculated. The performance of LCW-10 (Laser Diode Laboratories, Inc.) improved to a dosage of meg a rad (Si) before the onset of degradation. GRA

N78-18419# General Electric Co., Philadelphia, Pa. Space Div.
CHEMICAL LASER POTENTIAL OF SELECTED GROUP 4-A METAL OXIDES Final Report
M. J. Linevsky and R. A. Carabetta Kirtland AFB, N. Mex. AFWL Nov. 1977 69 p refs
(Contract F29601-76-C-0055; AF Proj. 1256)
(AD-A048779; AD-E200076; AFWL-TR-77-121) Avail: NTIS HC A04/MF A01 CSCL 20/5

This program consists of two parts. In the first part, which represents a continuation of the earlier flame work, attempts were made to produce high column densities of Sn/SnO, Si/SiO and Ge/GeO in H2/N2O flames containing metal additives.

Quantitative measurements on the kinetic behavior of these species were carried out to determine their lasing potential in this environment. In the second part, detailed measurements on the reactions of Sn(P3 sub 0) and (P3 sub 1) with N2O were carried out using a fast flow reactor and a tin atom generator. Rate constants of processes bearing on the production and quenching of SnO(3 sigma) were determined. GRA

N78-18420# Missouri Univ., Rolla. Dept. of Physics.
ATTACHMENT RATES IN RARE GAS HALIDE LASERS Annual Technical Report, 1 Dec. 1976 - 30 Nov. 1977
Kaare J. Nygaard 31 Dec. 1977 27 p refs
(Contract N00014-77-C-0100; ARPA Order 2840)
(AD-A048764; ATR-1) Avail: NTIS HC A03/MF A01 CSCL 20/5

Contents: Part A entitled 'Electron attachment in Dilute Fluorine-Helium Mixtures' has been accepted for publication in Applied Physics Letters; Part B entitled 'Electron Drift Velocities in Helium-Fluorine Gas Mixtures' has been submitted to Applied Physics Letters; Part C describes a point-to-plane electrical discharge that has been developed to produce a burst of electrons of 10 nsec duration. GRA

N78-18421# McDonnell-Douglas Research Labs., St. Louis, Mo.
LASER PULSE SPECKLE EFFECTS Final Report, 2 Jun. - 10 Oct. 1977
J. C. Leader 10 Oct. 1977 44 p refs Prepared in Cooperation with BCL Ohio
(Contract DAAG29-76-D-0100)
(AD-A048598; MDC-Q0634) Avail: NTIS HC A03/MF A01 CSCL 20/5

The fluctuations of a scattered laser pulse resulting from the illumination of uncorrelated, rough-surface areas of a target are examined. Amplitude fluctuations are treated as a random process with stationary increments. LADAR range-Doppler images can be degraded by these fluctuations. Field structure functions are calculated for conical targets and a normalized structure function is found to be temporally invariant. Range and Doppler smearing of LADAR target signatures is facilitated by the use of the local degree of coherence function which is simply related to the normalized structure function for targets having normalized local homogeneity (such as cones).
Author (GRA)

N78-18422# Technion - Israel Inst. of Tech., Haifa.
MACROSCOPIC DESCRIPTION OF LASER-TYPE MATTER Final Technical Report, Aug. 1976 - Aug. 1977
I. R. Senitzky Sep. 1977 34 p refs
(Grant DA-ERO-75-G-012)
(AD-A048442) Avail: NTIS HC A03/MF A01 CSCL 20/10

The relationship between the formalism developed previously for the macroscopic description of laser-type matter (macroscopic quantum mechanics) and several forms of semiclassical radiation theory are examined. It is shown that macroscopic quantum mechanics may be regarded as a generalization of conventional semiclassical radiation theory. The development of macroscopic quantum mechanics is carried further by extending its applicability to situations in which the atomic cooperation is less than maximum, and introducing a physically meaningful quantitative measure of the atomic cooperation for a given state. The theory is applied to a four-level laser for which atomic cooperation exists not only in the 'lasing' process but also in the pumping and relaxation processes. It is shown that under these conditions the laser exhibits properties similar to those of a parametric-amplifier with two idler frequencies. Author (GRA)

N78-18423# TRW Defense and Space Systems Group, Redondo Beach, Calif. Plasma Physics Dept.
MICROWAVE SIMULATION OF LASER PLASMA INTERACTIONS Final Report
14 May 1977 45 p refs
(Contract W-7405-eng-48)
(UCRL-13752) Avail: NTIS HC A03/MF A01

Various electron and ion current, electric field, and magnetic field probes were developed and tested. A three dimensional probe drive system was constructed in order to investigate two and three dimensional phenomena occurring in the microwave plasma interaction. In most of the experiments a 1 GHz, 40 kilowatt, pulsed RF source was used. The antenna was a 20 deg horn. A dipole fed parabolic antenna system capable of producing a focussed microwave beam at 2.3 GHz was developed and bench tested. ERA

N78-18424# National Physical Lab., Teddington (England). Div. of Quantum Metrology.
A DIGITAL FREQUENCY-OFFSET LOCK SYSTEM DESIGNED FOR USE WITH STABILIZED LASERS
W. R. C. Rowley Sep. 1977 19 p refs
(NPL-QU-40) Avail: NTIS HC A02/MF A01

An electronic system was designed for the stabilization of the frequency of a laser so as to maintain a precise frequency-offset with respect to another stabilized laser. Details are given for a system having switched frequency-offset values between 5 and 75 MHz, with 1 in 1 million accuracy. Circuit diagrams are given for the input amplifier (10mV rms sensitivity), the frequency dividers, reference oscillator, counting discriminator, and low-voltage output stages, together with suggested component layout schemes. The particular property of the counting discriminator scheme which makes it appropriate to the laser application is its ability to maintain a precise averaged value of the frequency-offset even if one of the oscillators is subject to very considerable frequency modulation. Author (ESA)

N78-18425# Istituto Superiore di Sanita, Rome (Italy). Lab. di Fisica.
THE MONTE CARLO SIMULATION OF THE LADON PHOTON BEAM FACILITY
C. Strangio 23 Jun. 1976 52 p refs
(ISS-P-76/10) Avail: NTIS HC A04/MF A01

The backward Compton scattering of laser light against high energy electrons was simulated with a Monte Carlo method. The main features of the photon beam produced are reported, and the numerical calculation is described carefully.
Author (ESA)

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N78-18426 California Univ., Davis.
THE DESIGN AND EVALUATION OF A TWO-PHASE TURBINE FOR LOW QUALITY STEAM-WATER MIXTURES Ph.D. Thesis
William Jabez Comfort, III 1977 210 p
Avail: Univ. Microfilms Order No. 77-27362

This report describes: (1) the details of the selection of the type of expander; (2) the design of an experimental expander for use in a clean two phase flow laboratory experiment; (3) the development of a numerical model for performance analysis and extrapolations; (4) experiments including static cascade performance with two phase fluid, disk friction and windage measurements, and two phase performance measurements of the experimental expander; (5) comparisons of the numerical model and experimental results; and (6) the prediction of the performance of an advanced design, indicating how performance improvements can be achieved. Full admission performance, based upon the numerical model and achievable nozzle thrust coefficients indicate that an engine efficiency of between 38 and 48 percent can be realized with present technology. Dissert. Abstr.

N78-18427 Purdue Univ., Lafayette, Ind.
THEORY AND METHODS FOR MODELLING ACOUSTICALLY LONG, UNPARTITIONED CAVITY RESONATORS FOR ENGINE EXHAUST SYSTEMS Ph.D. Thesis
Joseph William Sullivan 1974 170 p
Avail: Univ. Microfilms Order No. 77-30043

Two separate theories were developed for modelling the performance of acoustic resonators of the type where the center tube is perforated over the length of the cavity; and where the frequency range of operation extends beyond the range of validity of the classical branch theory. The first theory was suitable in the case where the perforate impedance can be considered distributed continuously over the surface of the tube. The second

theory was derived on the assumption that the perforate impedance is lumped at N discretely space stations along the length of the tube, and the wave motion between stations is planar. The limited studies so far show that resonators of the type mentioned exhibit: (1) remarkably broad bandwidths of attenuation for certain rather critical combinations of geometry, and (2) combined expansion chamber behavior at the lower frequencies when the porosity of the perforate becomes large.
Dissert. Abstr.

N78-18428 Old Dominion Univ., Norfolk, Va.
OPTIMAL CONTROL OF A LARGE SPACE TELESCOPE USING AN ANNULAR MOMENTUM CONTROL DEVICE Ph.D. thesis
Arun Anant Nadkarni 1977 190 p
Avail: Univ. Microfilms Order No. 77-29530

A general, readily available, user oriented computer program was developed to derive the open loop, optimal control law history for a general, high order (up to 25), nonlinear system. The program was used to achieve the design objective of deriving the open loop, optimal control law to retarget the Large Space Telescope from one stellar target to another with a minimum expenditure of energy. A specific example problem involving a manuever of the LST through a prescribed reorientation approximately 20 was solved. It was shown that the convergence of the iterative procedures to a local minima was highly dependent on the initial control history chosen, the initial choice of weighting matrices and the choice of the elements of these weighting matrices during convergence. Dissert. Abstr.

N78-18429*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STATISTICAL MODEL FOR ASPERITY-CONTACT TIME FRACTION IN ELASTOHYDRODYNAMIC LUBRICATION
Steven M. Sidik and John J. Coy (US Army R and T Labs., Cleveland) Feb. 1978 41 p refs
(NASA-TP-1130; E-9265) Avail: NTIS HC A03/MF A01 CSCL 13I

Relations for the asperity contact time fraction during elastohydrodynamic (EHD) lubrication of a typical ball bearing are presented. The analysis is based on a two-dimensional random surface model, and actual profile traces of the bearing surfaces were used as statistical sample records. The results of the analysis show that transition from 90 percent contact to 1 percent contact occurs within a dimensionless film thickness range of approximately 4 to 5. This thickness ratio is several times larger than reported in the literature where one-dimensional random surface models were used. Author

N78-18430# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
IMPACT DAMAGE IN BRITTLE MATERIALS IN THE PLASTIC RESPONSE REGIME Technical Report, 1 Jan. - 30 Sep. 1977
A. G. Evans, M. E. Bulden, G. E. Eggum, and M. Rosenblatt 30 Sep. 1977 41 p refs
(Contract N00014-75-C-0669)
(AD-A048266; SC5023.10TR) Avail: NTIS HC A03/MF A01 CSCL 19/1

The impact damage created in the plastic response regime has been characterized in terms of the surface extension and the penetration of the fractures. A numerical dynamic analysis has been performed (of a typical impact within this regime) to indicate some of the principal characteristics of the contact behavior and the stress field. The damage has then been analyzed - using simplified postulates based on key features of the impact dynamics and the quasi-static indentation fracture - which has enabled the primary material and target parameters affecting the impact fracture to be identified. Thereafter, some implications for strength degradation and erosion have been discussed. Author (GRA)

N78-18431# Northwestern Univ., Evanston, Ill.
THERMOELASTIC PHENOMENA IN LUBRICATED SLIDING CONTACT M.S. Thesis. Technical Report, Sep. 1975 - Sep. 1976
Barunendra N. Banerjee and Ralph A. Burton Jan. 1977 191 p refs
(Contract N00014-75-C-0761; NR Proj. 097-398)
(AD-A047926; Rept-5341-427) Avail: NTIS HC A09/MF A01 CSCL 20/1

Lubricated sliding motion is studied for thermoelastic effects, notably an instability that causes large thermoelastic deformation of a nominally flat surface. A configuration similar to a face seal is used, with one face consisting of a thermal conductor and the other of an insulator. The roles of the pertinent parameters and material properties are delineated. Simple equation is given for the threshold of thermoelastic instability when both faces are initially flat. For the case of an initially wavy conducting face, the model for viscous heating envisages a full, coherent film on the one hand and, on the other, a broken film with zero heating in the cavitation zones. For both models, the continuous thermoelastic deformation of the conducting face, with changing sliding speed, is discussed and criteria for the onset of instability are presented. Experiments are reported to corroborate the findings of the theoretical analyses.
Author (GRA)

N78-18432# Firestone Tire and Rubber Co., Akron, Ohio. Central Research Labs.
PHOSPHONITRILIC FLUOROELASTOMER FUEL HOSE. UTILIZATION OF EXTRUDED TUBES Final Report, 18 Aug. 1976 - 18 Jul. 1977
T. A. Antkowiak Oct. 1977 86 p
(Contract DAAK70-76-C-0239)
(AD-A047960; Rept-1432-2). Avail: NTIS HC A05/MF A01 CSCL 13/11

This report discusses the preparation of fuel resistant fuel hoses that are serviceable at temperatures as low as -70 F. The hoses were made from a phosphonitrilic fluoroelastomer with the tube sections extruded. Work directed toward attainment of extrudable compounds, the hose building procedure and laboratory evaluations of the hoses are also described in the report. Author (GRA)

N78-18433# Naval Ship Research and Development Center, Bethesda, Md.
FABRICATION OF PRESSURE TANK USING HY-100 STEEL
L. A. Becker Dec. 1977 76 p refs
(AD-A048767; DTNSRDC-77-0102) Avail: NTIS HC A05/MF A01 CSCL 13/4

A large pressure tank, fabricated of HY-100 steel, was constructed for the David W. Taylor Naval Ship Research and Development Center (DTNSRDC). During construction careful documentation was kept concerning materials, construction practices, inspection, and certification. This report publishes that information. It is prepared to help others who may need to construct items from HY-100 steel. Author (GRA)

N78-18434# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
COMPLEX MATERIALS HANDLING AND ASSEMBLY SYSTEMS Interim Progress Report
M. Athans, N. H. Cook, S. B. Gershwin, P. C. Kanellakis, and I. C. Shick 15 Apr. 1977 60 p
(Grant NSF APR-76-12036)
(PB-274539/6; ESL-IR-740; IPR-1) Avail: NTIS HC A04/MF A01 CSCL 13H

The focal point was flexible automation - the networking with programmable automatic transfer mechanisms of factory elements such as multi-purpose machines, storage locations, and inspection stations. The elimination of batch handling of materials in medium- to small-scale production of a diverse product line was developed. Topics covered included: a discussion of the goals, the method of approach, and the project organization; reports of visits to date with cooperating companies; a simplified computer simulation of flexible machining lines; and discussion of activities in the area of manufacturing network characterization, analysis, and modeling. GRA

N78-18435# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
COMPLEX MATERIALS HANDLING AND ASSEMBLY SYSTEMS Interim Progress Report
M. Athans, N. H. Cook, S. B. Gershwin, Y. Horev, and P. C. Kanellakis 30 Sep. 1977 108 p refs

(Grant NSF APR-76-12036)
(PB-274540/4; ESL-IR-771; IPR-2) Avail: NTIS HC A06/MF A01 CSCL 13H

Described are: recent results from a discrete computer simulation model of a flexible machining system; the prospects for applying the body of knowledge about computational complexity being developed in the computer science field to manufacturing network problems, and progress to date; progress in a study of the relationship between machine reliability and required sizes of inter-machine buffer storages for parts; and progress in developing a network flow model of a manufacturing system. GRA

N78-18436# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Berlin (West Germany). Inst. fuer Turbulenzforschung.
STUDY OF AN AIR LIFT PUMP IN A CENTRIFUGAL FORCE FIELD Ph.D. Thesis - Tech. Univ. Berlin
Jochen Mante 12 Sep. 1977 89 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-470)
(DLR-FB-77-40) Avail: NTIS HC A05/MF A01; DFVLR, Cologne DM 37,30

The pumping characteristics of an airlift pump and the two-phase flow occurring in the pipe line were studied under conditions at which the magnitude of the body force field was at most 10 times the gravitational acceleration. Mathematical fundamentals describing the pumping characteristics and the two-phase flow are presented whereby pipe flow losses are expressed largely as a function of the change in the momentum flow in the region where the two-phase flow is generated; calculation of the velocities of individual phases are based on an extension of presently known relationships. The theoretical premises were checked and required functions and constants were determined empirically. For this purpose an airlift pump was operated on a rotating platform with variable centrifugal acceleration and the pumping characteristics and resulting flow properties were measured. Results of these measurements confirm the validity of the assumptions and premises used. Author (ESA)

N78-18437# Energy Research and Development Administration, Bartlesville, Okla. Energy Research Center.
PERFORMANCE CHARACTERISTICS OF AUTOMOTIVE ENGINES IN THE UNITED STATES. REPORT NO. 8: MITSUBISHI MODEL 6DS7 DIESEL ENGINE Interim Report, Jul. 1975
W. F. Marshall and K. R. Stamper Aug. 1977 35 p
(Contract DOT-TSC-RA-75-10)
(PB-274374/8; BERC/OP-76/33; DOT-TSC-OST-77-48) Avail: NTIS HC A03/MF A01 CSCL 21G

Experimental data were obtained in dynamometer tests to determine fuel consumption and emissions (hydrocarbon, carbon monoxide, oxides of nitrogen, and smoke) at steady-state engine operating modes. The objective was to obtain engine performance data for estimating emissions and fuel economy for varied engine service and duty. Basic engine characteristic data required as input for engineering calculations involving ground transportation were provided. GRA

N78-18438# Energy Research and Development Administration, Bartlesville, Okla. Energy Research Center.
PERFORMANCE CHARACTERISTICS OF AUTOMOTIVE ENGINES IN THE UNITED STATES. REPORT NO. 9: CHRYSLER (1975) 225-CID 1-bbl ENGINE Interim Report, Jan. - Feb. 1976
W. F. Marshall Aug. 1977 39 p
(Contract DOT-TSC-RA-75-10)
(PB-274375/5; BERC/OP-77/3; DOT-TSC-OST-77-49) Avail: NTIS HC A03/MF A01 CSCL 21G

For abstract, see N78-18437

N78-18439# Energy Research and Development Administration, Bartlesville, Okla. Energy Research Center.
PERFORMANCE CHARACTERISTICS OF AUTOMOTIVE ENGINES IN THE UNITED STATES. REPORT NO. 10: CHEVROLET (1975) 250 CID 1-bbl ENGINE Interim Report, Dec. 1975 - Jan. 1976
W. F. Marshall and K. R. Stamper Aug. 1977 42 p
(Contract DOT/TSC-RA-75-10)
(PB-274376/3; BERC/OP-77/4; DOT-TSC-OST-77-50; Rept-10) Avail: NTIS HC A03/MF A01 CSCL 21G

For abstract, see N78-18437.

N78-18440# Energy Research and Development Administration, Bartlesville, Okla. Energy Research Center.
PERFORMANCE CHARACTERISTICS OF AUTOMOTIVE ENGINES IN THE UNITED STATES. REPORT NO. 11: CHRYSLER (1975) 318-CID 2-bbl ENGINE Interim Report, Nov. - Dec. 1975
W. F. Marshall Aug. 1977 42 p
(Contract DOT/TSC-RA-75-10)
(PB-274377/1; BERC/OP-77/5; DOT-TSC-OST-77-51; Rept-11) Avail: NTIS HC A03/MF A01 CSCL 21G

For abstract, see N78-18437.

N78-18237# Warsaw Univ. (Poland). Inst. of Mechanics.
ON THE NON-STANDARD FORMULATION OF MECHANICS
Cz. Wozniak *In* Polish Acad. of Sci. Arch. of Mech., Vol. 29, Issue 4 1977 p 593-605 refs (For availability see N78-18231 09-31)
Copyright. Avail: Issuing Activity

N78-19038*# Laboratoire Suisse de Recherches Horlogeres, Neuchatel (Switzerland).
WEAR-RESISTANT BALL BEARINGS FOR SPACE APPLICATIONS
H. Boving, H. E. Hintermann, W. Hanni, E. Bondivenne (ESA), M. Boeto (CNES, Toulouse), and E. Conde (CNES, Toulouse) *In* NASA. Goddard Res. Center The 11th Aerospace Mech. Symp. Apr. 1977 p 121-131 refs (For availability see N78-19026 09-99)
Avail: NTIS HC A11/MF A01 CSCL 13I

N78-19045*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FOCUS DRIVE MECHANISM FOR THE IUE SCIENTIFIC INSTRUMENT
Edward J. Devine and Thomas B. Dennis, Jr. *In its* The 11th Aerospace Mech. Symp. Apr. 1977 p 207-215 (For availability see N78-19026 09-99)
Avail: NTIS CSCL 13I

N78-19046*# Hawker Siddeley Dynamics Ltd., Stevenage (England). Space Div.
DESIGN AND DEVELOPMENT OF A SOLAR ARRAY DRIVE
Terence Rees and John M. Standing *In* NASA. Goddard Res. Center The 11th Aerospace Mech. Symp. Apr. 1977 p 217-235 (For availability see N78-19026 09-99)
Avail: NTIS HC A11/MF A01 CSCL 13I

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N78-18441# Abex Corp., Oxnard, Calif.
RELIABILITY, IMPROVEMENT WARRANTY (RIW) MID CONTRACT EVALUATION Report, Apr. 1973 - Aug. 1977
Oscar Markowitz 15 Oct. 1977 138 p refs
(Contract N00383-73-C-3318)
(AD-A048244; ASO-TEE-2-77) Avail: NTIS HC A07/MF A01 CSCL 15/5

RIW (Reliability Improvement Warranty) is considered by DOD (Department of Defense) as being in a trial phase during which the philosophies, techniques and applications could be wrung out. The Abex RIW contract, about which this report deals, innovated features of no exclusions, support, as well as early timing in the sequence of the life of an item. Thus, the report on this Abex RIW contract is meaningful in terms of evaluating RIW results against other most likely results should an otherwise normal support mode have been selected rather than RIW. The pre-contract history is provided as well as the main conditions and terms of the RIW contract itself. Each area of interest (Program, Administration, Engineering, Logistics and Economics) is reviewed and quantified from data developed for the RIW contract purposes as well as data from other Navy sources obtained for evaluation purposes. Throughout the report, results obtained within the Abex contract are compared against non-RIW alternatives as well as other experiences obtained with other equivalent engine driven hydraulic pumps supported without benefits of RIW. Conclusions to date can be made that the RIW goals anticipated were more than met and the RIW contract has, in fact, resulted in a most cost effective support alternative available to the Navy. Additionally, the RIW alternative has provided superlative support to the fleet within a Navy investment considerably less than other comparative units used in other front line Navy aircraft. The report provides considerable supportative detail and analysis to back up the above conclusions. Author (GRA)

N78-18442# Air Force Systems Command, Wright-Patterson AFB, Ohio.
RELIABILITY OF WELDED JOINTS AND STRUCTURES (SELECTED ARTICLES)
26 Jul. 1977 157 p Transl. into ENGLISH from Sbornik, Nadezhnost Svarnykh Soyedineniy i Konstruktsiy, izd-vo Mashinostr. (USSR), 1967 p 33-87, 99-112
(AD-A048336) Avail: NTIS HC A08/MF A01 CSCL 13/8

Contents: Estimation of the Reliability of Welded Joints; Effect of Technological Defects on Service Life and Reliability of Welded Joints; Reliability of Welded Constructions in Work in Corrosive Environments; Elimination of Residual Deformations During the Welding of Sheet Panel Constructions; Elimination of the Deformations of Loss of Stability During Plate Welding with Frames; Improvement in the Weldability of the Material SAP. GRA

N78-18443# SRI International Corp., Menlo Park, Calif.
MICROWAVE TECHNIQUES FOR NONDESTRUCTIVE EVALUATION OF CERAMICS Final Report, 30 Jun. 1976 - 30 Aug. 1977
Alfred J. Bahr Nov. 1977 73 p refs
(Contract DAAG46-76-C-0048)
(AD-A048582; AMMRC-CTR-77-29) Avail: NTIS HC A04/MF A01 CSCL 11/2

The ability of microwave energy to penetrate some kinds of ceramic materials at frequencies of 100 GHz and above suggests that microwave techniques may be useful for the nondestructive evaluation (NDE) of such materials. The work described in this report demonstrates the basic feasibility of using these techniques to detect and locate various types of inclusions (including voids) in Si3N4. Inclusions as small as 0.005 inch in diameter have been detected using frequencies in the range 50 to 100 GHz. Author (GRA)

N78-18444# European Space Research and Technology Center, Noordwijk (Netherlands). Product Assurance Div.
GUIDELINES FOR THE SIMULATION OF THE DEGRADATION OF SURFACE PROPERTIES UNDER COMBINED UV/PARTICLE RADIATION
Paris ESA Aug. 1977 23 p refs
(ESA-PSS-37/QRM-06T-Issue-1) Avail: NTIS HC A02/MF A01

A guide is presented for the performance of ground tests to determine the effects of combined UV/particulate radiation in space on materials used at the surface of a spacecraft. Some important terms are defined, and the basic requirements to which test facilities must conform are outlined. ESA

N78-18445# California State Dept. of Transportation, Sacramento. Transportation Lab.
NONDESTRUCTIVE INSPECTION OF STEEL, PHASE 1 Final Report
D. M. Lai Jun. 1977 48 p refs Sponsored by Federal Highway Admin.
(PB-274495/1; FHWA-CA-TL-6571-77-12) Avail: NTIS HC A03/MF A01 CSCL 13B

The nondestructive inspection methods used for the inspection of steel bridge structures during construction are discussed. These methods are radiography, ultrasonic, magnetic particle, and liquid penetrant. It concludes that no one method by itself will provide the assurance of a structurally sound bridge. Additional information is included in this report on acoustic emission and the acoustic crack detector and magnetic crack definer. GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N78-18446 Illinois Univ., Urbana-Champaign.
FULL-FIELD DETERMINATION OF THE FIRST DERIVATIVE OF NORMAL SURFACE DISPLACEMENT OF THIN PLATES USING SPECKLE PHOTOGRAPHIC INTERFEROMETRY Ph.D. Thesis
Gilbert Charles Brunnhoeffer 1977 67 p
Avail: Univ. Microfilms Order No. 77-26640

A ground glass plate was illuminated with coherent light to determine the slope of normal surface displacement for thin, transparent plates subjected to load. Two cases for the loading of the plates were considered. The first case was loading the plate such that the middle plane of the plate remained plane. The second case was loading the plate such that the middle plane of the plate warped out of its original plane. For each case the speckle pattern on the ground glass appears to shift when the pattern is viewed through the model as the model is subjected to an applied load. This apparent shift was recorded on high resolution film through a double exposure technique. The recorded speckle photographic negative was interpreted in an optical spatial filter system as well as by Fraunhofer diffraction on a point by point basis. Experimental demonstrations are presented. Dissert. Abstr.

N78-18447 Georgia Inst. of Tech., Atlanta.
FINITE DEFORMATION, ELASTIC-PLASTIC, FINITE ELEMENT ANALYSIS OF PLANAR CRACKS Ph.D. Thesis
Wen-Hwa Chen 1977 216 p
Avail: Univ. Microfilms Order No. 77-26190

A numerical procedure, is presented as accurate as possible, to analyze plane problems of ductile fracture under large scale yielding conditions, with arbitrary geometrical domains, under arbitrary loading conditions, and when the material properties can be characterized as elastic-plastic with arbitrary strain hardening. Based on a continuously updated Lagrangian incremental theory, a consistent finite deformation finite element analysis procedure was employed to account for large geometry changes near the crack tip (crack tip blunting). To account for this geometrical nonlinearity as well as the arbitrary strain hardening

behavior, an incremental tangent modulus method of analysis was considered. Dissert. Abstr.

N78-18448 Stanford Univ., Calif.
SELF-SIMILAR SOLUTIONS OF DISLOCATION GROUP DYNAMICS AND ITS APPLICATION TO ASEISMIC FAULTING PROCESSES Ph.D. Thesis
Li Chi Hsu 1977 162 p
Avail: Univ. Microfilms Order No. 77-25680

The self similar solutions of a group of dislocations subject to a nonlinear stress velocity law was solved using Cauchy integrals. The closed form solutions were obtained for the static equilibrium dislocation density functions. An upper bound error for neglecting the residual term around the singularity in the Cauchy integrals was established. The self similar solutions treated include dislocation free expansion with a constant mobility, and expansion subject to a time dependent applied stress field. The variations of the horizontal displacement parallel to the slip plane and the associated strain field as a result of dislocations movement were investigated. The evaluation concludes that under the assumption of conservation of dislocations, the displacement field in the proximity of the slip plane remains unchanged. The strain rate in the near field of the slip decreased with increasing time. Dissert. Abstr.

N78-18449 Illinois Univ., Urbana-Champaign.
STRESS AND VIBRATION ANALYSIS OF ORTHOTROPIC SHELLS OF REVOLUTION Ph.D. Thesis
John Hou-Shing Lau 1977 97 p
Avail: Univ. Microfilms Order No. 77-26695

A theoretical formulation using the finite difference variational technique was developed for the stress and vibration analysis of any orthotropic elastic thin shell of revolution. The general problem was reduced to that appropriate to any special shell shape by utilizing standard results from differential geometry. The potential energy function involves the Kirchhoff-Love first approximation and linearization in the displacement components u, v, w. This function was simplified by expressing the displacement components in terms of trigonometric functions in the circumferential direction and finite difference expressions in the meridional direction. The principle of stationary potential energy was utilized to derive the equilibrium equations while Hamilton's variational principle was utilized to derive the equations of motion. Dissert. Abstr.

N78-18450 Michigan Univ., Ann Arbor.
MATHEMATICAL MODEL FOR RUBBER HYSTERESIS Ph.D. Thesis
John Remo Luchini 1977 187 p
Avail: Univ. Microfilms Order No. 77-26296

A brief background in rubber behavior and viscoelastic theory is offered. Some general nonlinear viscoelastic theories are referenced. A theory is developed for the study of hysteresis in rubber. A model is modified by the addition of stops in the dampers. This model with discrete elements is used directly to simulate the hysteresis loops observed for carbon-filled vulcanized rubber. The theory developed to model a one-dimensional continuous-stochastic system. This formulation has two functions, one related to loss, the other to nonlinear elasticity. Three samples of carbon black filled vulcanized rubber were tested. The model is developed to define those experiments from which its characteristic values may best be determined. The model is used to predict the loss in one-dimensional cycling loading. Some areas where the model should be directly applicable are presented. Dissert. Abstr.

N78-18451 Illinois Univ., Urbana-Champaign.
ESTIMATING FATIGUE CRACK INITIATION AND PROPAGATION LIVES IN NOTCHED PLATES UNDER VARIABLE LOADING HISTORIES Ph.D. Thesis
Darrell Frederick Socie 1977 86 p
Avail: Univ. Microfilms Order No. 77-26754

A method of estimating fatigue crack initiation lives for notched members subjected to irregular loading histories was described. It was based on a knowledge of the local stresses and strains at the notch root and material property data. Techniques for estimating crack propagation lives for notched members were also described. Crack propagation was calculated from constant amplitude materials data using an effective stress intensity concept. Finite element analysis was used to determine residual stresses and strains due to notch geometry. Dissert. Abstr.

N78-18452 Illinois Univ., Urbana-Champaign.
NONLINEAR DYNAMIC ANALYSIS OF FLAT PLATE LAYERED BODIES ACCOUNTING FOR LARGE TRANSVERSE DEFLECTIONS Ph.D. Thesis
Pamela Jean Calvetti VanBlaricum 1977 93 p
Avail: Univ. Microfilms Order No. 77-26772

The development of a finite element model for the stress and displacement analysis of laminated orthotropic thick plate structures was investigated. A linear piecewise continuous displacement function assumed through the thickness to account for the thick plate structure. The loading in this problem was given as a surface pressure which is a function of space and time. The magnitude of the loading was such that it caused the yield stress of the materials to be exceeded. Large transverse deflections and large rotations out of the plane of the plate were expected and accounted for in the formulation of the strain displacement relations. Dissert. Abstr.

N78-18453 Maryland Univ., College Park.
THE APPLICATION OF INVARIANT IMBEDDING TO PROBLEMS IN ELASTIC STABILITY Ph.D. Thesis
Roger Owen Weiss 1977 333 p
Avail: Univ. Microfilms Order No. 77-28761

The method of invariant imbedding was applied to columns having various support conditions. The applied loads were either conservative or nonconservative. The use of invariant imbedding in nonconservative elastic stability leads to both the static and dynamic eigenlengths for the systems being analyzed. Distributed loads and damping were treated. A clamped free column loaded by a compressive force which remains tangent to the deformed axis at the end of the column was examined. Eigenlength stability conditions were derived and mode shapes were obtained for the nonconservative stability problem. The concept of imbedded solutions was employed to obtain eigenlength solutions for six related elastic stability problems for the clamped free column. Dissert. Abstr.

N78-18454 North Carolina State Univ., Raleigh.
THEORETICAL STUDIES OF CYCLIC STRAINING IN POLYCRYSTALLINE METAL PLASTICITY Ph.D. Thesis
Charan Singh 1977 88 p
Avail: Univ. Microfilms Order No. 77-29643

The hardening behavior and heat generation observed in plastic deformation of polycrystalline metals due to cyclic loads were investigated by quantitative evaluation of a discrete model. The numerical results were obtained for copper metal in particular. The model was subjected to nearly uniaxial stressing throughout the cyclic loading. An incremental procedure was adopted to determine the nonlinear plastic response of the model using a finite element type approximation. The method of analysis was described with theoretical development using a Green's function approach and a corresponding discrete form of the solution expressed in terms of a constrained minimization problem. The quantitative results were obtained in terms of stress-strain relationship and variation of work quantities including heat generation with the strain due to cyclic loads. Dissert. Abstr.

N78-18455 Clemson Univ., S.C.
ELASTIC-PLASTIC ANALYSIS OF A ROLLING DISK BY FINITE ELEMENTS Ph.D. Thesis
Hwei-Hwung Shaw 1977 197 p
Avail: Univ. Microfilms Order No. 77-29690

The elastic-plastic stress distribution for a disk rolling on a rigid track was investigated. The rolling body was idealized as a finite element plane stress model for which an incremental solution of the stationary contact problem was obtained in the inelastic range. Criteria for unloading are developed. The disk is rotated at various loads in the inelastic range until an elastic of elastic-plastic steady state is reached. Solution by the direct stiffness method does not present any difficulty, even in a case where unloading from the plastic state to an elastic state is the major characteristic of the problem. Numerical difficulties due to local collapse for an elastic perfectly-plastic material can easily

be overcome by assigning a small value to the strain-hardening parameter for the material. A refined linear strain triangular element in plane stress was developed for use in the inelastic range. Dissert. Abstr.

N78-18456 Colorado Univ., Boulder.
EXCITER FORCE APPORTIONING FOR MODAL VIBRATION TESTING USING INCOMPLETE EXCITATION Ph.D. Thesis
George Morosow 1977 144 p
Avail: Univ. Microfilms Order No. 77-29953

The objective of this thesis was to evolve an analytical method that will provide correct ratios of shaker forces for a sinusoidal modal vibration test. This procedure will limit the amount of laboratory personnel interpretation required to achieve a manual force ratio apportionment. The output of the algorithm developed provided shaker force ratios for each mode to be excited and the corresponding best fit mode shapes. This approach uses only experimental data and does not depend on any knowledge of the analytical model. The process consists of obtaining the dynamic influence coefficient matrix by performing frequency sweeps with one shaker at a time. Then an iterative process using a digital computer was initiated. The process was terminated when a set of best fit shaker forces and natural mode shapes was achieved. The shaker force information was fed into the laboratory test setup and the vibration test activated.
Dissert. Abstr.

N78-18457 Purdue Univ., Lafayette, Ind.
THE NONLINEAR RESPONSE AND STABILITY OF ROTATING SHELLS Ph.D. Thesis
Joseph William Klahs, Jr. 1976 224 p
Avail: Univ. Microfilms Order No. 77-30094

An investigation of the dynamic response and stability of thin structures undergoing an enforced general space motion is presented. In general, the motion gives rise to dynamic inertial loading that, in turn, induces a vibratory structural response. Further, because the enforced nature of the motion implies an unlimited supply of energy, it is possible for such systems to lose dynamic stability. To lay a general foundation for the study of thin moving structures, the governing equations of motion were derived with sufficient flexibility to handle cases of arbitrary surface geometry with constant thickness that involve any prescribed space motion. Complementing these equations, a general solution technique was illustrated by considering a specific geometry and type of motion. The example of a rectangular plate, spinning about a nutating axis parallel to (but not necessarily coincident with) an edge, demonstrates the salient features of a combined perturbation Galerkin solution method. Dissert. Abstr.

N78-18458*# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
THE STAGS COMPUTER CODE
B. O. Almroth and F. A. Brogan Feb. 1978 41 p refs
(Contract NAS1-10843)
(NASA-CR-2950) Avail: NTIS HC A03/MF A01 CSCL 20K

Basic information about the computer code STAGS (Structural Analysis of General Shells) is presented to describe to potential users the scope of the code and the solution procedures that are incorporated. Primarily, STAGS is intended for analysis of shell structures, although it has been extended to more complex shell configurations through the inclusion of springs and beam elements. The formulation is based on a variational approach in combination with local two dimensional power series representations of the displacement components. The computer code includes options for analysis of linear or nonlinear static stress, stability, vibrations, and transient response. Material as well as geometric nonlinearities are included. A few examples of applications of the code are presented for further illustration of its scope.
Author

N78-18459*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DEVELOPMENT AND APPLICATION OF AN OPTIMIZATION PROCEDURE FOR FLUTTER SUPPRESSION USING THE AERODYNAMIC ENERGY CONCEPT
E. Nissim (Technion - Israel Inst. of Tech.) and I. Abel Feb. 1978 39 p refs
(NASA-TP-1137; L-11909) Avail: NTIS HC A03/MF A01 CSCL 20K

An optimization procedure is developed based on the responses of a system to continuous gust inputs. The procedure uses control law transfer functions which have been partially determined by using the relaxed aerodynamic energy approach. The optimization procedure yields a flutter suppression system which minimizes control surface activity in a gust environment. The procedure is applied to wing flutter of a drone aircraft to demonstrate a 44 percent increase in the basic wing flutter dynamic pressure. It is shown that a trailing edge control system suppresses the flutter instability over a wide range of subsonic Mach numbers and flight altitudes. Results of this study confirm the effectiveness of the relaxed energy approach. Author

N78-18460*# Mechanical Technology, Inc., Latham, N. Y. Research and Development Div.
STIFFNESS AND DAMPING OF ELASTOMERIC O-RING BEARING MOUNTS Contractor Report, Sep. 1975 - Jan. 1977
A. J. Smalley Nov. 1977 75 p refs
(Contract NAS3-19751)
(NASA-CR-135328; MTI-78TR17) Avail: NTIS HC A04/MF A01 CSCL 13I

A test rig to measure the dynamic stiffness and damping of elastomer O rings was described. Test results for stiffness and loss coefficient in the frequency range from 50 Hz to 1000 Hz are presented. Results are given for three different materials, for five temperatures, for three amplitudes, for five values of squeeze for three values of stretch for three values of cross-section diameter and for three values of groove width. All test data points were plotted. In addition, trend summary plots were presented which compare the effect of material, temperature, amplitude, squeeze, stretch, cross-section diameter, and groove width. O ring deflections under a static load for different material were presented; and effective static stiffness values were compared with dynamic values. Author

N78-18461# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
HYBRID STRUCTURES OF REVOLUTION Final Report, Jan. 1976 - Sep. 1977
David Bushnell Sep. 1977 75 p refs
(Contract N00014-76-C-0692)
(AD-A047982; LMSC-D564369) Avail: NTIS MF A01 CSCL 13/13

This report consists of two parts: (1) A brief description of the implementation of a new equation solving and eigenvalue extraction package into BOSOR6 (a program for the analysis of hybrid structures of revolution) and 2. A new user's manual for BOSOR4. GRA

N78-18462# Weidlinger Associates, New York.
TRANSIENT RESPONSE OF SHELLS WITH INTERNALLY ATTACHED STRUCTURES
D. Ranlet and F. L. DiMaggio Aug. 1977 39 p refs
(Contract N00014-72-C-0119)
(AD-A048167; TR-21) Avail: NTIS HC A03/MF A01 CSCL 13/13

Equations of motion are derived for the transient response, to a shock wave, of a submerged shell with internal structures. A substructuring procedure, which does not require calculation of a system stiffness matrix, is employed to obtain these equations in a general manner for arbitrary internal structures approximated by finite elements. Author (GRA)

N78-18463# Weidlinger Associates, New York.
DYNAMIC RESPONSE OF A SUBMERGED ELASTIC STRUCTURE WITH ELASTIC STRUCTURES ATTACHED TO IT BY INELASTIC SPRINGS
F. L. DiMaggio Aug. 1977 28 p refs
(Contract N00014-72-C-0119)
(AD-A048166) Avail: NTIS HC A03/MF A01 CSCL 13/13

A procedure is described which may be used to obtain the dynamic response to shock loading of a submerged shell with internal structure attached to it by nonlinear mountings.
Author (GRA)

N78-18464# Brown Univ., Providence, R. I. Div. of Engineering.
EXPERIMENTS ON DYNAMIC PLASTIC LOADING ON FRAMES
S. R. Bodner and P. S. Symonds Jul. 1977 42 p refs
(Contract N00014-75-C-0860; Grant NSF ENG-74-21258)
(AD-A048687; N00014-0860/4) Avail: NTIS HC A03/MF A01 CSCL 13/13

Tests are described on plane frames of mild steel and titanium (commercial purity) in which high intensity short duration pressure pulses were applied transversely to the beam member either uniformly over this member or concentrated at its center. The objective was to examine applications of two estimation techniques (upper bounds on deflections and the mode approximation technique) for major response features of pulse loaded structures at large deflections, taking account of strong plastic strain rate sensitivity. Loads over a range such as to cause final deflections up to about a third of the span were applied by detonating explosive sheet. Agreement between estimated and measured final deflections was often very good (generally conservative) but the intrinsic error of the mode technique was not observed as expected. Author (GRA)

N78-18465# Army Materials and Mechanics Research Center, Watertown, Mass.
RESIDUAL STRESSES IN AN ANISOTROPIC THICK HOLLOW CYLINDER OF CHEMICALLY VAPOR-DEPOSITED MATERIAL DUE TO UNIFORM COOL-DOWN Final Report
Francis I. Baratta Oct. 1977 32 p
(DA Proj. 1T1-61101-A-91A)
(AD-A048301; AMMRC-TR-77-21) Avail: NTIS HC A03/MF A01 CSCL 11/6

Residual stresses are derived for a transversely anisotropic thick hollow cylinder which has been chemically vapor deposited at an elevated temperature. Such stresses arise because of the differential rates of contraction in the radial and tangential directions and the anisotropic elastic constants. Residual stress distributions for cylinders with a wall ratio (outer to inner radius) of 1.30 of pyrolytic graphite and pyrolytic silicon carbide (alpha SiC) are presented as a function of the radius to inner radius. The effect of the variation of the elastic anisotropy on the tangential stress at the inner and outer radii is presented as a function of the wall ratio. Finally, the tangential and axial stresses at the inner and outer radii and the maximum radial stress of chemically vapor-deposited alpha SiC are presented as a function of the wall ratio. Author (GRA)

N78-18466# Lincoln Lab., Mass. Inst. of Tech., Lexington.
FINITE ELEMENT CAPABILITIES IN MIT LINCOLN LABORATORY VERSION OF STRUDL
Stephen S. Britten 30 Sep. 1977 82 p refs
(Contract F19628-76-C-0002)
(AD-A048605; ESD-TR-77-266; TN-1977-17) Avail: NTIS HC A05/MF A01 CSCL 13/13

The well-known, general-purpose structural analysis program ICES-STRUDL has been used extensively at M. I. T. Lincoln Laboratory since its public release in 1967. Since that original release, several updates, issued by the original developers and the ICES Users Group, have produced changes in programs and documentation. Likewise, additional development and enhancement of ICES-STRUDL have occurred at M. I. T. Lincoln Laboratory on those areas (such as finite elements, dynamics, etc.) specifically of interest to the Laboratory. This report describes the finite element capabilities in the M. I. T. Lincoln Laboratory version of ICES STRUDL and can therefore serve as a user's manual. Sections are devoted to specification of finite element geometry, element properties, and element loading. Finite element modelling considerations are discussed and three examples are presented to illustrate capabilities often needed at the laboratory, but not described in other ICES-STRUDL documentation. Author (GRA)

N78-18467# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
NASTRAN STRESS RECOVERY PACKAGE Final Report, Sep. 1976 - Mar. 1977
Steven E. Lamberson Aug. 1977 39 p
(AF Proj. 1467)
(AD-A048744; AFFDL-TR-77-84) Avail: NTIS HC A03/MF A01 CSCL 09/2

This user's manual presents the stress recovery package. This series of programs allows automated scanning of NASTRAN element stresses. This package can be used interactively or as part of a NASTRAN batch run. The package is operational on the CDC 6000 series computers. Author (GRA)

N78-18468# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abt. Kunststoffe.
PROGRESS IN STRUCTURAL BONDING THROUGH EFFECTIVE BONDLINE STRESS ANALYSIS
Walter Althof 15 Aug. 1977 23 p refs Presented at the 22d SAMPE Symp. on Diversity, Technol., Explosion, San Diego, Calif., 26-28 Apr. 1977
(DLR-IB-152-77/18) Avail: NTIS HC A02/MF A01

After the successful trial of testing thick adherent lap shear specimens and cured adhesive-material it is now possible to determine proper data of shear stiffness vs. shear stress, yield stress, strain at fracture before and after exposing in environment conditions, temperature, creep, and fatigue. By making use of these data and of approximate computing methods, controlled by measuring the bond line deformations, it is also possible to determine an effective bond line stress distribution helpful in the prediction of loading limits of structural adhesively bonded joints. Author (ESA)

N78-18469# Oxford Univ. (England). Engineering Lab.
CALCULATIONS OF STRESSES IN WALL IRONING
Bradley Dodd 1977 20 p refs
(OUEL-1187/77) Avail: NTIS HC A02/MF A01

The experimentally determined effects of die angle, friction, and reduction on the ironing process are briefly described and the limitations of the slab method for the calculation of the ironing load are outlined. Hill's two-centered fan slip-line field for ironing is discussed and the statical inadmissibility of some of the solutions are described. A further limitation on these fields is shown to occur when the hydrostatic pressure at the slip-line cusp at the punch surface is less than or equal to -k. Under these circumstances it is predicted that thinning of the material at the punch will occur, which in practice would give a product with a reduced wall thickness and an increased internal diameter. Author (ESA)

N78-18470# Oxford Univ. (England). Engineering Lab.
PLANE-STRAIN GENERAL YIELDING OF A PRESSURISED CYLINDRICAL SHELL CONTAINING A LONG PART-THROUGH NOTCH
B. Dodd, M. Shiratori, and C. Ruiz 1977 21 p refs Sponsored in part by Sci. Res. Council and Brit. Council
(OUEL-1199/77) Avail: NTIS HC A02/MF A01

A slip-line field is proposed for the plane-strain general yielding of a cylindrical shell with a long longitudinal part-through notch. The constraint factors resulting from this analysis are generally less than unity and the alternative term, weakening factor, is suggested. Results are compared with those of a simple lower bound analysis and in the limit when the flank angle equals 180 deg both sets of results are almost coincident for ratios of thickness to radius less than or equal to 0.01.
Author (ESA)

N78-18471# Oxford Univ. (England). Engineering Lab.
THE PLANE-STRAIN GENERAL YIELDING OF NOTCHED MEMBERS DUE TO COMBINED AXIAL FORCE AND BENDING. VOLUME 1: WEDGE-SHAPED NOTCHES WITH LARGE FLANK ANGLES
Masaki Shiratori and Bradley Dodd 1977 36 p refs Sponsored in part by Brit. Council and Sci. Res. Council 2 Vol.
(OUEL-1206/77-Vol-1) Avail: NTIS HC A03/MF A01

The slip-line field proposed by Green for the general yielding of notched plates in pure bending is generalized to provide solutions for the general yielding of notched plates subjected to combined bending and axial force. For symmetrically notched plates subjected to arbitrary combinations of axial force and bending moment, two constraint factors are obtained, T1 due to the axial force and M1 due to the bending moment. These constraint factors are shown to have a characteristic locus expressed by two parabolae in the T1-M1 plane. In one extreme

case where both flank angles are equal to p, i.e., a flat plate, the locus is the same as that obtained by Prager. The general yielding loci of single notched plates and plates containing symmetrical notches of the same flank angle are derived as special cases of the general problem and some practical problems involving single notches are considered. Author (ESA)

N78-18472# Oxford Univ. (England). Engineering Lab.
FAILURE ANALYSIS OF PRESSURE VESSELS WITH DEFECTS Final Report, Jun. 1977
P. H. Hodkinson Jun. 1977 24 p refs
(OUEL-1209/77) Avail: NTIS HC A02/MF A01

A reappraisal of some of the concepts used in engineering fracture mechanics as related to pressure vessels was made. Aspects covered include an energy balance approach to failure analysis and the fracture toughness parameter. An experimental program to study the failure mechanisms of model specimens and vessels made of polycarbonate and steel is described. ESA

N78-18473# Oxford Univ. (England). Engineering Lab.
THE PLANE-STRAIN GENERAL YIELDING OF NOTCHED MEMBERS DUE TO COMBINED AXIAL FORCE AND BENDING. VOLUME 2: DEEP CIRCULAR NOTCHES
Bradley Dodd and Masaki Shiratori 1977 33 p refs Sponsored in part by Sci. Res. Council and Brit. Council 2 Vol.
(OUEL-1210/77-Vol-2) Avail: NTIS HC A03/MF A01

The slip-line fields proposed by Green for the plane-strain general yielding of notched plates in pure bending are generalized to provide solutions for notched plates subjected to combined axial force and bending. Deep symmetrical circular notches and single circular notches are considered. For notched plates subjected to arbitrary combinations of axial force and bending, two constraint factors are obtained, T1 due to the axial force and M1 due to the bending moment. These constraint factors are shown to have characteristic relationships on the T1-M1 plane for the single notched plate and the symmetrically notched plate. The derivations of these general yielding loci are described in detail and the statistical and kinematical limitations of the slip-line fields are discussed. Finally, it is demonstrated that the corresponding strain-rate vectors are normal to these loci and that, therefore, these loci can be regarded as plastic potentials. Author (ESA)

N78-18474# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Aeroelastik.
IMPROVEMENT OF MODAL METHODS FOR DYNAMIC RESPONSE PROBLEMS OF LINEAR ELASTIC STRUCTURES
Fritz Kiessling 8 Aug. 1977 41 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-467)
(DLR-FB-77-33) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 21

In modal dynamic response computations of linear elastic structures global approximations were used for the neglected normal modes to get better results. The necessary input data can be obtained from vibration tests. The possible improvements were demonstrated by calculations on a continuum model and on a discrete model. ESA

N78-18475# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
THE DETERMINATION OF CRACK PROPAGATION CURVES WITH THE AID OF ELECTRON MICROSCOPY
E. A. B. DeGraaf, W. J. VanderVet, and J. A. M Boogers 10 Jul. 1977 16 p refs
(Contract RNLAF-RB-KL-1973/74/75-C4)
(NLR-TR-75165-U) Avail: NTIS HC A02/MF A01

The considerations behind the development of an elongated replica grid especially tailored for the derivation of crack propagation curves are described. Initial experiences with it are presented together with suggestions for further work.
Author (ESA)

N78-18232# Polish Academy of Sciences, Warsaw.
ANALYSIS OF THE USEFULNESS OF DIFFUSION EQUATIONS FOR THE DESCRIPTION OF DISLOCATION MOBILITY AND RELATED PHENOMENA
S. Pilecki *In its* Arch. of Mech., Vol. 29, Issue 4 1977 p 505-517 refs (For availability see N78-18231 09-31)
Copyright. Avail: Issuing Activity

N78-18234# Polish Academy of Sciences, Warsaw.
THEORY OF DISCLINATIONS IN ELASTIC COSSERAT MEDIA
J. P. Nowacki *In its* Arch. of Mech., Vol. 29, Issue 4 1977 p 531-545 refs (For availability see N78-18231 09-31)
Copyright. Avail: Issuing Activity

N78-18235# Technical Univ. of Denmark, Lyngby. Structural Research Lab.
MODEL LAWS FOR GRANULAR MEDIA AND POWDERS WITH A SPECIAL VIEW TO SILO MODELS
J. Nielsen *In* Polish Acad. of Sci. Arch. of Mech., Vol. 29, Issue 4 1977 p 547-560 refs Presented at the Euromech. Colloq. 84 on Mech. of Granular Mater., Warsaw, Jul. 1976 (For availability see N78-18231 09-31)
Copyright. Avail: Issuing Activity

N78-18236# Technische Hogeschool, Delft (Netherlands). Dept. of Civil Engineering.
MATHEMATICAL ELABORATION OF THE DOUBLE SLIDING, FREE ROTATING MODEL
G. DeJosselinDeJong *In* Polish Acad. of Sci. Arch. of Mech., Vol. 29, Issue 4 1977 p 561-591 refs Presented at the Euromech. Colloq. 84 on Mech. of Granular Mater., Warsaw, Jul. 1976 (For availability see N78-18231 09-31)
Copyright. Avail: Issuing Activity

N78-18239# Polish Academy of Sciences, Warsaw.
FIELD EQUATIONS FOR MICROPOLAR CURRENT AND A HEAT CONDUCTING MAGNETICALLY-SATURATED SOLID
N. Naerlovic-Veljkovic *In its* Arch. of Mech., Vol. 29, Issue 4 1977 p 625-630 refs (For availability see N78-18231 09-31)
Copyright. Avail: Issuing Activity

N78-18241 Polish Academy of Sciences, Warsaw. Inst. of Fundamental Technological Research.
DISCLINATION KINEMATICS
E. Kossecka and R. DeWit (NBS, Wash., D. C.) *In its* Arch. of Mech., Vol. 29, Issue 5 1977 p 633-651 refs (For availability see N78-18240 09-31)
Copyright. Avail: Issuing Activity

N78-18243 Oxford Univ. (England). Mathematical Inst.
QUASI-PERFECT ELASTICITY. 1: THEORETICAL FOUNDATIONS
A. Paglietti (Cagliari Univ., Italy) *In* Polish Acad. of Sci. Arch. of Mech., Vol. 29, Issue 5 1977 p 659-672 refs Sponsored by NATO (For availability see N78-18240 09-31)
Copyright. Avail: Issuing Activity

N78-18244 Polish Academy of Sciences, Warsaw. Faculty of Engineering Science.
PRELIMINARY EXPERIMENT ON ACOUSTOELASTICITY FOR STRESS ANALYSIS
H. Fukuoka and H. Toda *In its* Arch. of Mech., Vol. 29, Issue 5 1977 p 673-686 refs (For availability see N78-18240 09-31)
Copyright. Avail: Issuing Activity

N78-18246 Polish Academy of Sciences, Warsaw. Inst. of Fundamental Technological Research.
FORCES IN MATERIAL SPACE
D. Rogula *In its* Arch. of Mech., Vol. 29, Issue 5 1977 p 705-713 refs (For availability see N78-18240 09-31)
Copyright. Avail: Issuing Activity

N78-18247 Nairobi Univ. (Kenya). Dept. of Mathematics.
EXISTENCE OF SOLUTIONS FOR THE PRESTRESSED NON-LINEAR ORTHOTROPIC HEATED PLATES
B. O. Calleb *In* Polish Acad. of Sci. Arch. of Mech., Vol. 29, Issue 5 1977 p 715-722 refs (For availability see N78-18240 09-31)
Copyright. Avail: Issuing Activity

N78-18248 Illinois Univ., Urbana.
DIFFUSION IN DISLOCATION FIELDS
E. C. Aifantis, D. E. Beskos (Minnesota Univ., Minneapolis), and W. W. Gerberich (Minnesota Univ., Minneapolis) *In* Polish Acad. of Sci. Arch. of Mech., Vol. 29, Issue 5 1977 p 723-740 refs (For availability see N78-18240 09-31)
Copyright. Avail: Issuing Activity

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography*.

N78-18476 Rutgers - The State Univ., New Brunswick, N. J.
EVALUATION OF CIRCULATION IN PARTIALLY STRATIFIED ESTUARIES AS TYPIFIED BY THE HUDSON RIVER Ph.D. Thesis
Karim Arieby Abood 1977 451 p
Avail: Univ. Microfilms Order No. 77-24951

The methods developed in the course of this study include the: Advective Salt Budget, Two Layer Stratified Flow, Generalized Salinity Profiles, Semi-Analytical Closed Form Solution, and the Three Dimensional Steady State Model. The first four methods were previously developed and/or generalized in this study. The three dimensional model is the main contribution of this study.
Dissert. Abstr.

N78-18477 Kansas Univ., Lawrence.
ON THE FEASIBILITY OF MONITORING SOIL MOISTURE USING ACTIVE MICROWAVE REMOTE SENSING: AN EXPERIMENTAL EVALUATION Ph.D. Thesis
Percy P. Batlivala 1977 123 p
Avail: Univ. Microfilms Order No. 77-28834

The radar backscattering coefficient of terrain, sigma, was considered as a function of the moisture content and surface roughness of the soil and of the vegetation cover. The effects of surface roughness and moisture content variations on sigma were evaluated, for the bare soil case, in terms of experimental data acquired over a wide range of surface roughness. The vegetation cover influence was considered as having a backscatter component of its own in addition to attenuating the soil backscatter component. The utility of remote sensing measurements for the estimation of soil moisture were briefly considered as well.
Dissert. Abstr.

N78-18478 Kansas Univ., Lawrence.
CROPLAND INVENTORIES USING AN ORBITAL IMAGING RADAR Ph.D. Thesis
Thomas Floyd Bush 1977 202 p
Avail: Univ. Microfilms Order No. 77-28844

Results of an evaluation of radar's capabilities to provide data suitable for crop species identification are presented. The study relied upon basic scattering data acquired with the Kansas University Remote Sensing Laboratory MAS 8-18, an angle and polarization agile radar spectrometer capable of precise and absolute measurements of the radar scattering coefficient. Scattering data were acquired from five field categories approximately once every six days during the growing season. A data base was generated having angle, polarization, spectra and temporal dimensions. The data were first degraded by a random component to account for signal scintillation and then analyzed by means of an F-test procedure. Results suggest that a dual polarized radar operating at about 14 GHz at an off-nadir angle of around 50 deg is most suitable for crop classification purposes.
Dissert. Abstr.

N78-18479 Iowa Univ., Iowa City.
EFFECTS OF VERTICAL DISTORTION ON THERMALHYDRAULIC MODELING OF SURFACE DISCHARGES Ph.D. Thesis
Shie-yui Liong 1977 171 p
Avail: Univ. Microfilms Order No. 77-28477

This is an experimental investigation of the near-field behavior of rectangular surface jets that are discharged at an angle of 90 degrees to the ambient flow into a rectangular channel of limited depth and width. Multiple regression analysis is used to correlate several geometric characteristics of the thermal plume. Results of the regression analysis show that: (1) an increase in the width of the discharge channel would result in a strong increase in the surface plume area and cross-sectional plume area for both two- and three-dimensional jets, but a strong decrease in the vertical thickness of the plume for the three-dimensional jet, and (2) an increase in the jet discharge would result in a strong increase in the vertical thickness of the plume for both two- and three-dimensional jets.
Dissert. Abstr.

N78-18480* National Aeronautics and Space Administration, Washington, D. C.
IMPROVED LANDSAT TO GIVE BETTER VIEW OF EARTH RESOURCES
22 Feb. 1978 42 p
(NASA-News-Release-78-22; P78-10026) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 22A

The launch data of LANDSAT 3 is announced. The improved capability of the spacecrafts' remote sensors (the return beam vidicon and the multispectral scanner) and application of LANDSAT data to the study of energy supplies, food production, and global large-scale environmental monitoring are discussed along with the piggyback amateur radio communication satellite-OSCAR-D, the Plasma Interaction Experiment, and the data collection system onboard LANDSAT 3. An assessment of the utility of LANDSAT multispectral data is given based on the research results to date from studies of LANDSAT 1 and 2 data. Areas studied include agriculture, rangelands, forestry, water resources, environmental and marine resources, cartography, land use, demography, and geological surveys and mineral/petroleum exploration.
J.M.S.

N78-18481*+ National Aeronautics and Space Administration, Washington, D. C.
EARTH RESOURCES: A CONTINUING BIBLIOGRAPHY WITH INDEXES, ISSUE 15, OCTOBER 1977
Oct. 1977 100 p
(NASA-SP-7041(15)) Avail: NTIS HC E05 CSCL 05B

This bibliography lists 387 reports, articles, and other documents introduced into the NASA scientific and technical information system between July 1 and September 30, 1977. Emphasis is placed on the use of remote sensing and geophysical instrumentation in spacecraft and aircraft to survey and inventory natural resources and urban areas. Subject matter is grouped according to agriculture and forestry, environmental changes and cultural resources, geodesy and cartography, geology and mineral resources, hydrology and water management, data processing and distribution systems, instrumentation and sensors, and economic analysis.
Author

N78-18482*# Texas A&M Univ., College Station. Remote Sensing Center.
SPECTRAL MEASUREMENT OF WATERSHED COEFFICIENTS IN THE SOUTHERN GREAT PLAINS Final Report
Bruce J. Blanchard, Principal Investigator and Walter Bausch Jan. 1978 58 p refs ERTS
(Contract NAS5-22534)
(E78-10073; NASA-CR-155718; RSC-3273) Avail: NTIS HC A04/MF A01 CSCL 08H

The author has identified the following significant results. It was apparent that the spectra calibration of runoff curve numbers cannot be achieved on watersheds where significant areas of timber were within the drainage area. The absorption of light

by wet soil conditions restricts differentiation of watersheds with regard to watershed runoff curve numbers. It appeared that the predominant factor influencing the classification of watershed runoff curve numbers was the difference in soil color and its associated reflectance when dry. In regions where vegetation grown throughout the year, where wet surface conditions prevail or where watersheds are timbered, there is little hope of classifying runoff potential with visible light alone.

N78-18483*# Pennsylvania State Univ., University Park. Office for Remote Sensing of Earth Resources.

USE OF LANDSAT-1 DATA FOR THE DETECTION AND MAPPING OF SALINE SEEPS IN MONTANA

G. A. May, Principal Investigator and G. W. Petersen Mar. 1976 87 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS

(Contract NAS5-2304)

(E78-10074; NASA-CR-156686; ORSER-SSEL-TR-4-76) Avail: NTIS HC A05/MF A01 CSCL 08G

The author has identified the following significant results. April, May, and August are the best times to detect saline seeps. Specific times within these months would be dependent upon weather, phenology, and growth conditions. Saline seeps can be efficiently and accurately mapped, within resolution capabilities, from merged May and August LANDSAT 1 data. Seeps were mapped by detecting salt crusts in the spring and indicator plants in the fall. These indicator plants were kochia, inkweed, and foxtail barley. The total hectares of the mapped saline seeps were calculated and tabulated. Saline seeps less than two hectares in size or that have linear configurations less than 200 meters in width were not mapped using the LANDSAT 1 data. Saline seep signatures developed in the Coffee Creek test site were extended to map saline seeps located outside this area.

N78-18484*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.

A MAXIMAL CHROMATIC EXPANSION METHOD OF MAPPING MULTICHANNEL IMAGERY INTO COLOR SPACE

Richard D. Juday and R. A. Abotteen, Principal Investigators Jan. 1978 13 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. EREP

(Contract NAS9-15200)

(E78-10075; NASA-CR-151617; LEC-10830) Avail: NTIS HC A02/MF A01 CSCL 14E

The author has identified the following significant results. A color film generation method that maximally expands the chromaticity and aligns Kauth brightness with the gray axis was presented. In comparison with the current LACIE film product, the new color film product has more contrast and more colors and apears to be brighter. The field boundaries in the new product were more pronounced than in the current LACIE product. The speckle effect was one problem in the new product. The yellowness speckle can be treated using an equation. This equation can be used to eliminate any speckle introduced by the greenness. This product leads logically toward another that will employ quantitative colorimetry which will account for some of the eye's perception of color stimuli.

N78-18485*# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.

COST BENEFIT ANALYSIS OF THE TRANSFER OF NASA REMOTE SENSING TECHNOLOGY TO THE STATE OF GEORGIA Final Report

R. P. Zimmer, Principal Investigator, R. D. Wilkins, D. L. Kelly, and D. M. Brown Nov. 1977 144 p refs EREP

(Contract NAS9-15283)

(E78-10076; NASA-CR-151615) Avail: NTIS HC A07/MF A01 CSCL 05B

The author has identified the following significant results. First order benefits can generally be quantified, thus allowing quantitative comparisons of candidate land cover data systems. A meaningful dollar evaluation of LANDSAT can be made by a cost comparison with equally effective data systems. Users of LANDSAT data can be usefully categorized as performing three general functions: planning, permitting, and enforcing. The value of LANDSAT data to the State of Georgia is most sensitive to the parameters: discount rate, digitization cost, and photo acquisition cost. Under a constrained budget, LANDSAT could provide digitized land cover information roughly seven times more frequently than could otherwise be obtained. Thus on one hand, while the services derived from LANDSAT data in comparison to the baseline system has a positive net present value, on the other hand if the budget were constrained, more frequent information could be provided using the LANDSAT system than could otherwise be obtained.

N78-18486*# Alaska Univ., Fairbanks. Geophysical Inst.

APPLICATION OF REMOTE SENSING DATA TO SURVEYS OF THE ALASKAN ENVIRONMENT Annual Report, 1 Jul. 1974 - 30 Jun. 1975

J. M. Miller, Principal Investigator and A. E. Belon 30 Jun. 1975 224 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS

(Grant NGL-02-001-092)

(E78-10077; NASA-CR-155731) Avail: NTIS HC A10/MF A01 CSCL 08F

There are no author-identified significant results in this report.

N78-18487*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.

SELECTION OF A SEVENTH SPECTRAL BAND FOR THE LANDSAT-D THEMATIC MAPPER Final Report, 15 Aug. 1977 - 15 Jan. 1978

Quentin A. Holmes, Principal Investigator and Daniel R. Nuesch Jan. 1978 96 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. EREP

(Contract NAS9-15362)

(E78-10078; NASA-CR-151624; ERIM-300100-4-f) Avail: NTIS HC A05/MF A01 CSCL 08B

The author has identified the following significant results. Each of the candidate bands were examined in terms of the feasibility of gathering high quality imagery from space while taking into account solar illumination, atmospheric attenuation, and the signal/noise ratio achievable within the TM sensor constraints. For the 2.2 micron region and the thermal IR region, inband signal values were calculated from representative spectral reflectance/emittance curves and a linear discriminant analysis was employed to predict classification accuracies. Based upon the substantial improvement (from 78 to 92%) in discriminating zones of hydrothermally altered rocks from unaltered zones, over a broad range of observation conditions, a 2.08-2.35 micron spectral band having a ground resolution of 30 meters was recommended.

N78-18488*# Virginia Univ., Charlottesville. Dept. of Environmental Sciences.

LANDSAT APPLICATION OF REMOTE SENSING TO SHORELINE-FORM ANALYSIS Final Report, 3 Apr. 1975 - 3 Jan. 1978

Robert Dolan, Bruce Hayden, and Jeffrey Heywood, Principal Investigators Mar. 1978 119 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS

(Contract NAS5-20999)

(E78-10079; NASA-CR-155741) Avail: NTIS HC A06/MF A01 CSCL 05B

The author has identified the following significant results. Using Assateague Island, Cape Hatteras, and Cape Lookout, significantly high correlations were found for most of the six barrier island sections that were examined. Relationships were not consistent from island to island. It was concluded that coastal vulnerability to storm damage can not be assessed based on coastal orientation alone. When orientation data were combined with erosion data for individual barrier islands, the relationship could be used as a basis for barrier island classification. A method was developed to obtain large amounts of historical data on surface coastal process from aerial photography, which was called the orthogonal grid address system. Data on shoreline change and overwash penetration gathered on over 400 km of the

mid-Atlantic coast, are being used by various federal and state agencies for planning purposes.

N78-18489*# Atomic Energy Commission, Dacca (Bangladesh).
INVESTIGATIONS USING DATA FROM LANDSAT 2
Quarterly Report, Oct. - Dec. 1977
Anwar Hossain, Principal Investigator Jan. 1978 4 p refs Sponsored by NASA ERTS
(E78-10080; NASA-CR-155742) Avail: NTIS HC A02/MF A01 CSCL 08B

The author has identified the following significant results. Ground truth data collected in coastal areas confirm the sedimentation base line at five fathom depth and less. Forestry ground truth at Supati in Sunderbasn was found to conform with stratifications in aerial photos and in some satellite imagery.

N78-18490*# National Aeronautics and Space Administration, Washington, D. C.
ON THE DEVELOPMENT OF EARTH OBSERVATION SATELLITE SYSTEMS
Nov. 1977 38 p Transl. into ENGLISH of "Chikyu kansoku eisei shisutemu no kaihatsu ni tsuite" Sci. and Technol. Agency of Japan, Tokyo, 12 Jul. 1977 p 1-81 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Science and Technology Agency of Japan, Tokyo
(Contract NASw-2790)
(NASA-TM-75064) Avail: NTIS HC A03/MF A01 CSCL 22A

Subsequent to the launching of the first LANDSAT by NASA, Japan has recognized the importance of data from earth observation satellites, has conducted studies, and is preparing to develop an independent system. The first ocean observation satellite will be launched in 1983, the second in 1985. The first land observation satellite is scheduled to be launched in 1987 and by 1990 Japan intends to have both land and ocean observation systems in regular operation. The association reception and data processing systems are being developed.
Author

N78-18491*# National Aeronautics and Space Administration, Washington, D. C.
OUTLINE OF THE SURVEY ON THE DEVELOPMENT OF EARTH OBSERVATION SATELLITES
Dec. 1977 84 p Transl. into ENGLISH from Japanese report, Jul. 1977 p 1-98 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Science and Technology Agency, Tokyo
(Contract NASw-2790)
(NASA-TM-75065) Avail: NTIS HC A05/MF A01 CSCL 22A

An independent earth observation system with land and sea satellites to be developed by Japan is described. Visible and infrared radiometers, microwave radiometers, microwave scatterometers, synthetic aperture radar, and laser sensors are among the instrumentation discussed. Triaxial attitude control, basic technology common to sea and land observation satellites as well as land data analytical technology developed for U.S. LANDSAT data are reviewed.
Author

N78-18492*# National Aeronautics and Space Administration, Washington, D. C.
PRINCIPLE CHARACTERISTICS OF THE NATIONAL EARTH OBSERVATION SATELLITE. PROJECT SPOT
M. Cazenave 31 Oct. 1977 36 p ref Transl. into ENGLISH of "Characteristiques Principles du Satellite National d'Observation de la Terre. Project SPOT", Doc. CST/D863 CNES, Paris, 31 Oct. 1977 p 1-30 Transl. by Transemantics, Inc., Wash., D. C.
(Contract NASw-2792)
(NASA-TM-75081) Avail: NTIS HC A03/MF A01 CSCL 22A

A recent meeting of the Economic and Social Committee examined the programs and means currently being implemented by France in the field in the field of space research and industry which could bring about fast results. This was prompted by man's desire to insure rational resource management of his planet and by man's awareness of the definite contribution that space observation can make to this field of research. Through discussion, the Economic and Social Committee has approved the plan for creating an earth observation satellite. A detailed discussion of the principle characteristics of this earth observation satellite include the objectives, the orbit, characteristics and operations of the platform, maintenance, attitude measurement, the power available and many other characteristics.
Author

N78-18493*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
THE LARSYS EDUCATIONAL PACKAGE: INSTRUCTOR'S NOTES FOR USE WITH THE DATA 100
John C. Lindenlaub and James D. Russell 5 Nov. 1977 95 p
(Contract NAS9-14970)
(NASA-CR-151636; LARS-Pub-110577) Avail: NTIS HC A05/MF A01 CSCL 05B

The LARSYS Educational Package is a set of instructional materials developed to train people to analyze remotely sensed multispectral data using LARSYS, a computer software system. The materials included in this volume have been designed to assist LARSYS instructors as they guide students through the LARSYS Educational Package. All of the materials have been updated from the previous version to reflect the use of a Data 100 Remote Terminal.
Author

N78-18494*# Texas A&M Univ., College Station. Remote Sensing Center.
JSME SCATTEROMETER DATA PROCESSING
Final Report
Aug. 1977 54 p refs
(Contract NAS9-14875)
(NASA-CR-151639; RSC-3337) Avail: NTIS HC A04/MF A01 CSCL 05B

A software system was developed which processes digitized scatterometer data from the 13.3 GHz, 1.6 GHz and 400 MHz scatterometer systems. In addition to this, the hardware capability has been developed to recover the raw analog radar signals and the aircraft parameters from an ADAS data stream in a digital format for processing by the software package. Software for the preparation of data reports and chart presentation of scattering coefficients time histories has also been developed. This report documents the development of the software, describes key components of the processing system and presents examples of the processed data and procedure for software operation.
Author

N78-18495*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CLUSTER COMPRESSION ALGORITHM: A JOINT CLUSTERING/DATA COMPRESSION CONCEPT
E. E. Hilbert 1 Dec. 1977 160 p refs
(Contract NAS7-100)
(NASA-CR-155780; JPL-Publ-77-43) Avail: NTIS HC A08/MF A01 CSCL 05B

The Cluster Compression Algorithm (CCA), which was developed to reduce costs associated with transmitting, storing, distributing, and interpreting LANDSAT multispectral image data is described. The CCA is a preprocessing algorithm that uses feature extraction and data compression to more efficiently represent the information in the image data. The format of the preprocessed data enables simply a look-up table decoding and direct use of the extracted features to reduce user computation for either image reconstruction, or computer interpretation of the image data. Basically, the CCA uses spatially local clustering to extract features from the image data to describe spectral characteristics of the data set. In addition, the features may be used to form a sequence of scalar numbers that define each picture element in terms of the cluster features. This sequence, called the feature map, is then efficiently represented by using source encoding concepts. Various forms of the CCA are defined and experimental results are presented to show trade-offs and characteristics of the various implementations. Examples are provided that demonstrate the application of the cluster compression concept to multi-spectral images from LANDSAT and other sources.
Author

N78-18496*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
A SYSTEM ANALYSIS OF THE 13.3 GHz SCATTEROMETER
J. R. Wang Oct. 1977 121 p refs
(Contract NAS9-15200)
(NASA-CR-151627; LEC-11354) Avail: NTIS

HC A06/MF A01 CSCL 20N

The performance of the 13.3 GHz airborne scatterometer system which is used as a microwave remote sensor to detect moisture content of soil is analyzed with respect to its antenna pattern, the signal flow in the receiver data channels, and the errors in the signal outputs. The operational principle and the sensitivity of the system, as well as data handling are also described. The dielectric property of the terrain surface, as far as the scatterometer is concerned, is contained in the assumed forms of the functional dependence of the backscattering coefficient of the incident angle. Author

N78-18497*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

ANALYSIS OF DATA SYSTEMS REQUIREMENTS FOR GLOBAL CROP PRODUCTION FORECASTING IN THE 1985 TIME FRAME

Sanford W. Downs, Paul A. Larsen, and Dietwald A. Gerstner Feb. 1978 48 p refs

(NASA-TP-1164; M-248) Avail: NTIS HC A03/MF A01 CSCL 02C

Data systems concepts that would be needed to implement the objective of the global crop production forecasting in an orderly transition from experimental to operational status in the 1985 time frame were examined. Information needs of users were converted into data system requirements, and the influence of these requirements on the formulation of a conceptual data system was analyzed. Any potential problem areas in meeting these data system requirements were identified in an iterative process. Author

N78-18498*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SENSORS WORKSHOP SUMMARY REPORT

1977 157 p Workshop held at Greenbelt, Md., 11-12 May 1977

(NASA-TM-74978) Avail: NTIS HC A08/MF A01 CSCL 14B

A review of the efforts of three workshops is presented. The presentation describes those technological developments that would contribute most to sensor subsystem optimization and improvement of NASA's data acquisition capabilities, and summarizes the recommendations of the sensor technology panels from the most recent workshops. Author

N78-18499*# General Electric Co., Philadelphia, Pa. Space Div.

POST LANDSAT D ADVANCED CONCEPT EVALUATION (PLACE)

1 Dec. 1977 67 p Sponsored by NASA

(NASA-CR-155769) Avail: NTIS HC A04/MF A01 CSCL 22A

An outline is given of the mission objectives and requirements, system elements, system concepts, technology requirements and forecasting, and priority analysis for LANDSAT D. User requirements and mission analysis and technological forecasting are emphasized. Mission areas considered include agriculture, range management, forestry, geology, land use, water resources, environmental quality, and disaster assessment. J.M.S.

N78-18500*# Pan American Univ., Edinburg, Tex.

A PLANT CANOPY LIGHT ABSORPTION MODEL WITH APPLICATION TO WHEAT

J. E. Chance and E. W. LeMaster [1977] 38 p refs

(Grant NsG-9033)

(NASA-CR-155778) Avail: NTIS HC A03/MF A01 CSCL 02C

From the light absorption model the absorption of light in the photosynthetically active region of the spectrum was calculated for a Penjamo wheat crop for several situations including: (1) the percent absorption of the incident radiation by a canopy having a four layer structure; (2) the percent absorption of light by the individual layers within a four layer canopy and by the underlying soil; (3) the percent absorption of light by each vegetative canopy layer for variable sun angle; and (4) the cumulative solar energy absorbed by the developing wheat canopy as it progresses from a single layer through its growth stages to a three layer canopy. This calculation was also presented as a function of the leaf area index. Author

N78-18501# PRC Information Sciences Co., Rome, N. Y.

CARTOGRAPHIC COMPILATION STUDY. VOLUME 1. SYSTEM REQUIREMENTS AND DESIGN ANALYSES Final Technical Report, Apr. 1974 - Jul. 1977

M. L. Taylor and R. P. OConnor Griffiss AFB, N. Y. RADC Oct. 1977 297 p 2 Vol.

(Contract F30602-72-C-0036)

(AD-A048220; RADC-TR-77-340-Vol-1) Avail: NTIS HC A13/MF A01 CSCL 08/2

The report contains an analysis of the digital cartographic compilation process with attendant hardware and software requirements. A review of available off-the-shelf hardware is included with a trade-off analysis of available hardware vs required hardware. A selection of the best hardware configuration is made and a throughput analysis is performed comparing the configured system to the current manual process. Author (GRA)

N78-18502# PRC Information Sciences Co., Rome, N. Y.

CARTOGRAPHIC COMPILATION STUDY. VOLUME 2. DESIGN SPECIFICATIONS, ADVANCED REVISION AND COMPILATION SYSTEM (ARCS) Final Technical Report, Apr. 1974 - Jul. 1977

M. L. Taylor and R. P. OConnor Griffiss AFB, N. Y. RADC Oct. 1977 269 p 2 Vol.

(Contract F30602-73-C-0036)

(AD-A048221; RADC-TR-77-340-Vol-2) Avail: NTIS HC A12/MF A01 CSCL 08/2

This report contains the hardware capability specification and complete functional flow, batch and interactive processing, for the advanced digital compilation/revision system. Author (GRA)

N78-18503# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Mobility and Environmental Systems Lab.

AN EXAMPLE OF APPYLING REMOTE SENSING TO A CORPS OF ENGINEERS ARCHEOLOGICAL PROBLEM Final Report, Sep. 1976 - Aug. 1977

Lewis E. Link, Jr. Nov. 1977 22 p ref

(DA Proj. 4A7-62720-A-896)

(AD-A048106; AEWES-MP-M-77-14) Avail: NTIS HC A02/MF A01 CSCL 14/5

This report documents a study that illustrates the applicability of conventional remote sensor imagery for obtaining archeological information. The study exemplifies the use of imagery for a problem common to both Corps district offices and military facilities; determining if a feature of archeological significance will be impacted by some planned action such as construction or training. In this instance, aerial photography and supporting historical charts were readily available for an area suspected to be the site of an old French village, Old Kaskaskia, near St. Genevieve, Missouri. The U. S. Army Engineer District, St. Louis, was interested in the site of the village because of a proposed levee improvement project under consideration for the area. The available information and nature of the problem provided an excellent opportunity to demonstrate at low cost the applicability of remote sensing techniques for locating features of archeological significance at military installations and acquire information relevant to an existing Corps district problem. Author (GRA)

N78-18504# Geological Survey, Tallahassee, Fla.

SALINE-WATER INTRUSION IN THE FERNANDINA BEACH AREA, NASSAU COUNTY, FLORIDA

Roy W. Fairchild and C. B. Bentley Sep. 1977 32 p refs Prepared in cooperation with St. Johns River Water Management District, Palatka, Fla.

(PB-274015/7; USGS/WRD/WRI-77/075) Avail: NTIS HC A03/MF A01 CSCL 08H

The Floridan aquifer is the major source of water for municipal and industrial use in northeastern Nassau County, Florida. Pumpage from the aquifer at Fernandina Beach has created a cone of depression in the potentiometric surface which is at or below sea level in a 35-square mile area. Since 1880 water levels have declined more than 120 feet near the center of pumping, and chloride concentrations have increased from about 20 to a maximum of 800 milligrams per liter in some deep wells. The saline water probably is connate water which comes from zones below 1,250 and 2,000 feet. Several alternate methods to control the migration of saline water are discussed. GRA

N78-18505# Swedish Space Corp., Solna.
QUICK-LOOK CAPABILITY IN A EUROPEAN EARTH RESOURCES SATELLITE DATA NETWORK. VOLUME 2: APPENDICES 5 TO 7 Final Report
Paris ESA 15 Apr. 1977 148 p 2 Vol.
(Contract ESA-SC/128-HQ)
(FU15-4-vol-2-App-5-7; ESA-CR(P)-977-Vol-2-App-5-7) Avail: NTIS HC A07/MF A01

Additional information is provided related to the assessment of an optimum quick-look system to meet user requirements in an earth resources satellite data network (Earthnet) to be developed by the European Space Agency. ESA

N78-18506# Bureau of Landing Management, Washington, D. C. Div. of Minerals Environmental Assessment.
PROPOSED INCREASE IN OIL AND GAS LEASING ON THE OUTER CONTINENTAL SHELF, VOLUME 1 Final Environmental Statement
7 Jul. 1975 801 p
(PB-273700/5; BLM-ME-78-14-Vol-1) Avail: NTIS HC A99/MF A01; HC also available in set of 3 reports HC E99, PB-273699-SET CSCL 13B

A proposal of the Department of the Interior is considered which would accelerate its Outer Continental Shelf (OCS) oil and gas leasing in the years 1975 through 1978. The program suggests conducting six lease sales each year. Lease sales in some or all frontier areas by 1978 are proposed. Many of the areas have little or no history of OCS oil and gas development. Volume 1 of the statement includes the description of the proposed action and the description of the environment in which the action would take place. GRA

N78-18507# Bureau of Landing Management, Washington, D. C. Div. of Minerals Environmental Assessment.
PROPOSED INCREASE IN OIL AND GAS LEASING ON THE OUTER CONTINENTAL SHELF, VOLUME 2 Final Environmental Statement
7 Jul. 1975 1041 p refs
(PB-273701/3; BLM-ME-78-15-Vol-2) Avail: NTIS HC A99/MF A01; also available in set of 3 reports HC E99 PB-273699-Set CSCL 13B

Volume 2 of the statement includes the environmental impact of the proposal and other impact analyses, mitigating measures, alternatives to the proposed action and consultation and coordination with others, including comments on the draft statement. GRA

N78-18508# Bureau of Landing Management, Washington, D. C. Div. of Minerals Environmental Assessment.
PROPOSED INCREASE IN OIL AND GAS LEASING ON THE OUTER CONTINENTAL SHELF, VOLUME 3 Final Environmental Statement
7 Jul. 1975 938 p refs
(PB-273702/1; BLM-ME-78-16-Vol-3) Avail: NTIS HC A99/MF A01; also available in set of 3 reports HC E99, PB-273699-SET CSCL 13B

For abstract, see N78-18506.

N78-18509*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CUMULATIVE NON-US STANDARD CATALOG Yearly Report, 1976 - 1977
1977 84 p
(NASA-TM-79359; GSFC/LN-77/013A; NTISUB/C/139-013A) Avail: NTIS HC A05/MF A01 CSCL 05B

The LANDSAT 1 Non-U. S. Cumulative Catalog lists Non-U. S. imagery acquired by LANDSAT 1 which was processed and input to the data files during the referenced year. Data, such as date acquired, cloud cover, and image quality are given for each scene. The microfilm roll and frame on which the scene may be found is also given Author

N78-18510*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CUMULATIVE US STANDARD CATALOG Yearly Report, 1976 - 1977
1977 179 p
(NASA-TM-79358; GSFC/LU-77/013A; NTISUB/C/138-013A) Avail: NTIS HC A09/MF A01 CSCL 05B

The LANDSAT 1 U. S. Cumulative Catalog lists U. S. imagery acquired by LANDSAT 1 which was processed and input to the data files during the referenced year. Data, such as date acquired, cloud cover, and image quality are given for each scene. The microfilm and frame on which the scene may be found is also given. Author

N78-18511# Federal Coordinating Council for Science, Engineering and Technology, Washington, D. C. Committee on Water Resources Research.
DIRECTIONS IN US WATER RESEARCH: 1978 - 1982 Final Draft Report
Apr. 1977 153 p refs
(PB-274278/1) Avail: NTIS HC A08/MF A01 CSCL 13B

The effectiveness of the 10 year program of water resources research sets forth a perspective for the role that our water resources must play in the U.S. Issues in which water is a vital consideration are identified. The Committee on Water Resources Research attempted to refocus the needed program in water research for at least the next five years. Author

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N78-18512 North Carolina State Univ., Raleigh.
A COMPUTER ANALYSIS OF HETEROJUNCTION AND GRADED BANDGAP SOLAR CELLS Ph.D. Thesis
Joseph Edward Sutherland 1977 149 p
Avail: Univ. Microfilms Order No. 77-29659

A computer program was designed for the analysis of variable composition solar cells and the program was applied to several proposed solar cell structures using appropriate semiconductor materials. The program was completed and used to study devices made of Al(x) Ga(1-x)As, Ga(x)In(1-x)As and GaAs(1-x)P(x) with the intention of determining the material compositions and device dimensions that produce high conversion efficiency. Background discussions are included concerning variable composition solar cell phenomena and the theoretical techniques used to model device behavior. The results of the computer analysis of various proposed cell structures are then presented. Dissert. Abstr.

N78-18513 North Carolina State Univ., Raleigh.
SOLAR ENERGY STORAGE SUBSYSTEM UTILIZING LATENT HEAT OF PHASE CHANGE Ph.D. Thesis
Kunjvihari Jagmohandas Mody 1977 83 p
Avail: Univ. Microfilms Order No. 77-29672

The problems of heat transfer associated with the design of a solar energy storage sub system utilizing latent heat of phase change also called thermal capacitor are examined. The solution of the fundamental problem of phase change with generalized boundary condition at the surface and the analysis of the finless thermal capacitor are presented. The arrangement selected consists of two slabs of phase change material with heat transfer medium circulating in between in a channel flow. The analysis of a single cell of finned thermal capacitor is also obtained; using known methods, by finite differences and by a new method. It is observed that the new method gives fairly good accuracy with considerably reduced computational time. The fin material content is optimized using this approximate method and finally the analysis of a finned thermal capacitor is presented.
Dissert. Abstr.

N78-18514 Colorado State Univ., Fort Collins.
STOCHASTIC MODELS OF SOLAR ENERGY SYSTEMS Ph.D. Thesis

Gerard Francis Lameiro 1977 76 p
Avail: Univ. Microfilms Order No. 77-28314

A stochastic approach is presented to the generalized solar energy space heating performance analysis problem. Specifically, Markov chain models are developed to represent ambient temperature, insolation, hot water load and system performance. From the Markov transition probability matrices for these variables, long term expected performance is calculated. The theoretical development is implemented in FORTRAN 4 on a Control Data 6400 Computer System. Computational experience gained, indicates the stochastic approach requires much less time than is required for standard dynamic simulation approaches with comparable performance results. Dissert. Abstr.

N78-18515*# Ionics, Inc., Watertown, Mass. Research Div.
ANION PERMSELECTIVE MEMBRANE Summary Report
Samuel Alexander and Russell B. Hodgdon Jul. 1977 77 p
(Contract NAS3-20108)
(NASA-CR-135316) Avail: NTIS HC A05/MF A01 CSCL 10A

The objective of NAS 3-20108 was the development and evaluation of improved anion selective membranes useful as efficient separators in a redox power storage cell system being constructed. The program was divided into three parts, (a) optimization of the selected candidate membrane systems, (b) investigation of alternative membrane/polymer systems, and (c) characterization of candidate membranes. The major synthesis effort was aimed at improving and optimizing as far as possible each candidate system with respect to three critical membrane properties essential for good redox cell performance. Substantial improvements were made in 5 candidate membrane systems. The critical synthesis variables of cross-link density, monomer ratio, and solvent composition were examined over a wide range. In addition, eight alternative polymer systems were investigated, two of which attained candidate status. Three other alternatives showed potential but required further research and development. Each candidate system was optimized for selectivity. Author

N78-18516*# Motorola, Inc., Phoenix, Ariz. Semiconductor Group.
PHASE 1 OF THE AUTOMATED ARRAY ASSEMBLY TASK OF THE LOW COST SILICON SOLAR ARRAY PROJECT Annual Technical Report
M. G. Coleman, R. A. Pryor, L. A. Grenon, and I. A. Lesk Feb. 1977 115 p refs Sponsored in part by ERDA Prepared for JPL
(Contracts NAS7-100; JPL-954363)
(NASA-CR-155935; ERDA/JPL-954363-77/1; Rept-2258/4) Avail: NTIS HC A06/MF A01 CSCL 10A

The state of technology readiness for the automated production of solar cells and modules is reviewed. Individual process steps and process sequences for making solar cells and modules were evaluated both technically and economically. High efficiency with a suggested cell goal of 15% was stressed. It is concluded that the technology exists to manufacture solar cells which will meet program goals. J.M.S.

N78-18517*# Pennsylvania Univ., Philadelphia.
HOT FORMING OF SILICON SHEET, SILICON SHEET GROWTH DEVELOPMENT FOR THE LARGE AREA SILICON SHEET TASK OF THE LOW COST SILICON SOLAR ARRAY PROJECT Quarterly Report, 31 Mar. - 30 Jun. 1977
C. D. Graham, Jr., A. H. Gholamnezhad, C. Lall, D. P. Pope, P. Strauss, and M. Wolf 26 Jul. 1977 14 p Sponsored in part by ERDA Prepared for JPL
(Contracts NAS7-100; JPL-954506)
(NASA-CR-155934; QR-5; ERDA/JPL-954506-77/3) Avail: NTIS HC A02/MF A01 CSCL 10A

Progress on a program to determine the conditions under which sheets of silicon might be produced by a rolling process is described. Samples of p-type polycrystalline silicon produced by chemical vapor deposition deformed at strain rates of 5 sec -1 to strains of between 36% and 56% and are subsequently recrystallized and submitted for electrical evaluation. The effect of the environment in the deformation and annealing apparatus was determined. Author

N78-18518*# AeroChem Research Labs., Inc., Princeton, N. J.
SYNTHESIS OF SILANE AND SILICON IN A NON-EQUILIBRIUM PLASMA JET Quarterly Report, 21 Mar. - 20 Jun. 1977
H. F. Calcote and W. Felder Jul. 1977 35 p refs Sponsored in part by ERDA Prepared for JPL
(Contracts NAS7-100; JPL-954560)
(NASA-CR-155933; QR-4; ERDA/JPL-954560-77/4; AeroChem-TN-176) Avail: NTIS HC A03/MF A01 CSCL 10A

The feasibility of high volume, low cost production of high purity silane or solar grade silicon using a non equilibrium hydrogen atom plasma jet was studied through reactions of hydrogen atoms in the plasma jet with chlorosilanes. Products of the H/SiCl4 reaction were collected and quantitatively analyzed using a fractionation/distillation-mass spectrometric technique. Conversion of SiCl4 to lower chlorosilanes and solid (Si) was on the order of 10%. The percentage conversion was found to depend upon equivalence ration (ratio of SiCl4 to H concentrations) and reaction zone pressure. Electronic grade reagent SiCl4 gave smaller product yield and different product distribution than did technical grade. Real time, in situ mass spectrometric sampling of the H/H2/SiCl4 reaction zone gases was initiated. Quantitative results have not been obtained due to the complexity of the chlorosilane mass spectra, and consequent resolution and sensitivity difficulties with the mass spectrometer. Improvements in the instrumentation needed for these measurements are discussed. Author

N78-18519*# Solarex Corp., Rockville, Md.
ENERGY REQUIREMENT FOR THE PRODUCTION OF SILICON SOLAR ARRAYS Quarterly Report, 21 Mar. - 20 Jun. 1977
Joseph Lindmayer, Manfred Wihl, Alan Scheinine, and Andrew Morrison Jul. 1977 61 p refs Sponsored in Part by ERDA Prepared for JPL
(Contracts NAS7-100; JPL-954606)
(NASA-CR-155932; QR-2; ERDA/JPL-954606-77/2) Avail: NTIS HC A04/MF A01 CSCL 10A

An assessment of potential changes and alternative technologies which could impact the photovoltaic manufacturing process is presented. Topics discussed include: a multiple wire saw, ribbon growth techniques, silicon casting, and a computer model for a large-scale solar power plant. Emphasis is placed on reducing the energy demands of the manufacturing process. J.M.S.

N78-18520*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
THERMAL ENERGY STORAGE Final Report
P. G. Grodzka and E. A. Picklesimer 10 Feb. 1978 28 p refs
(Contract NAS8-31100)
(NASA-CR-150563; LMSC-HREC-TR-D568188) Avail: NTIS HC A03/MF A01 CSCL 10C

The general scope of study on thermal energy storage development includes: (1) survey and review possible concepts for storing thermal energy; (2) evaluate the potentials of the surveyed concepts for practical applications in the low and high temperature ranges for thermal control and storage, with particular emphasis on the low temperature range, and designate the most promising concepts; and (3) determine the nature of further studies required to expeditiously convert the most promising concept(s) to practical applications. Cryogenic temperature control by means of energy storage materials was also included. Author

N78-18521*# Wyle Labs., Inc., Huntsville, Ala. Solar Energy Systems Div.
INDOOR THERMAL PERFORMANCE EVALUATION OF DAYSTAR SOLAR COLLECTOR
Ken Shih, Sr. Nov. 1977 50 p Revised Prepared for DOE
(Contract NAS8-32036)
(NASA-CR-150511; WYLE-TR-510-10-Rev-A) Avail: NTIS HC A03/MF A01 CSCL 10A

The test procedures used and results obtained from a test program to obtain thermal performance data on a Daystar Model 21B, S/N 02210, Unit 2, liquid solar collector under simulated conditions are described. The test article is a flat plate solar collector using liquid as a heat transfer medium. The absorber plate is copper and coated with black paint. Between the tempered

low iron glass and absorber plate is a polycarbonate trap used to suppress convective heat loss. The collector incorporates a convector heat dump panel to limit temperature excursions during stagnation. The following tests were conducted: (1) collector thermal efficiency; (2) collector time constant; (3) collector incident angle modifier; (4) collector heat loss coefficient; and (5) collector stagnation. Author

N78-18522*# Sigma Research, Inc., Richland, Wash.
SYSTEM DESIGN PACKAGE: MAXI-THERM S-101 HEATING MODULE, PASSIVE HEAT EXCHANGER
Oct. 1977 38 p Prepared for DOE
(Contract NAS8-32260)
(NASA-CR-150516) Avail: NTIS HC A03/MF A01 CSCL 10A

This document is the specification which establishes the requirements for the design, installation, and performance of a passive heat exchanger module with auxiliary heaters for use with solar heating systems. It designates the Interim Performance Criteria applicable to the subsystem and defines any deviations. This document also includes the manufacturing instructions and required materials and parts for the Maxitherm S101 Heating Module. Author

N78-18523*# IBM Federal Systems Div., Huntsville, Ala.
INSTALLATION PACKAGE - SIMS PROTOTYPE SYSTEM 1A
Dec. 1976 35 p Prepared for DOE
(Contract NAS8-32036)
(NASA-CR-150524) Avail: NTIS HC A03/MF A01 CSCL 10A

This report consists of details for the installation, operation and maintenance of a prototype heating and hot water system, designed for residential or light commercial applications. This system consists of the following subsystems: air type collectors, pebble bed thermal storage, air handling unit, air to water heat exchanger, hot water preheat tank, auxiliary energy, ducting system. Author

N78-18524*# IBM Federal Systems Div., Huntsville, Ala.
SITE DEPENDENT FACTORS AFFECTING THE ECONOMIC FEASIBILITY OF SOLAR POWERED ABSORPTION COOLING
J. C. Bartlett Jan. 1978 37 p Revised Prepared for DOE
(Contract NAS8-32036)
(NASA-CR-150533; Rept-76W-0128-Rev) Avail: NTIS HC A03/MF A01 CSCL 10A

A procedure was developed to evaluate the cost effectiveness of combining an absorption cycle chiller with a solar energy system. A basic assumption of the procedure is that a solar energy system exists for meeting the heating load of the building, and that the building must be cooled. The decision to be made is to either cool the building with a conventional vapor compression cycle chiller or to use the existing solar energy system to provide a heat input to the absorption chiller. Two methods of meeting the cooling load not supplied by solar energy were considered. In the first method, heat is supplied to the absorption chiller by a boiler using fossil fuel. In the second method, the load not met by solar energy is net by a conventional vapor compression chiller. In addition, the procedure can consider waste heat as another form of auxiliary energy. Commercial applications of solar cooling with an absorption chiller were found to be more cost effective than the residential applications. In general, it was found that the larger the chiller, the more economically feasible it would be. Also, it was found that a conventional vapor compression chiller is a viable alternative for the auxiliary cooling source, especially for the larger chillers. The results of the analysis give a relative rating of the sites considered as to their economic feasibility of solar cooling. Author

N78-18525*# Wyle Labs., Inc., Huntsville, Ala. Solar Energy Systems Div.
THERMAL PERFORMANCE OF MSFC HOT AIR COLLECTORS UNDER NATURAL AND SIMULATED CONDITIONS
K. Shih, Sr. Nov. 1977 39 p Revised Prepared for DOE
(Contract NAS8-32036)
(NASA-CR-150506; WYLE-TR-531-05-Rev-A) Avail: NTIS HC A03/MF A01 CSCL 10A

The procedures used and the results obtained from an evaluation test program conducted to determine the thermal performance and structural characteristics of selected MSFC--designed hot air collectors under both real and simulated environmental conditions are described. Five collectors were tested in the three phased program. A series of outdoor tests were conducted to determine stagnation temperatures on a typical bright day and to determine each collector's ability to withstand these temperatures. Two of the collectors experienced structural deformation sufficient to eliminate them from the remainder of the test program. A series of outdoor tests to evaluate the thermal performance of collector S/N 10 under certain test conditions were performed followed by a series of indoor tests to evaluate the thermal performance of the collector under closely controlled simulated conditions. Author

N78-18526*# Solafern Ltd., Bourne, Mass.
SOLAFERN SOLAR SYSTEM DESIGN BROCHURE
Dec. 1977 47 p Prepared for DOE
(Contract NAS8-32246)
(NASA-CR-150515) Avail: NTIS HC A03/MF A01 CSCL 10A

A complete residential solar space heating and hot water system is described. Low maintenance, durable, and efficient air heating collectors are used. The collectors have a selective absorber and a tempered glass cover nearly one-quarter of an inch thick with an aluminum frame. The solar energy can be delivered directly to the living area when there is a demand; otherwise, it is stored in the form of hot water. Hot water storage is accomplished through the use of an air-to-water exchanger. The hot water storage is used simultaneously to preheat the domestic hot water, as well as to store energy for space heating. Author

N78-18527*# IBM Federal Systems Div., Huntsville, Ala.
SIMS PROTOTYPE SYSTEM 1 TEST RESULTS: ENGINEERING ANALYSIS
19 Jan. 1978 70 p Prepared for DOE
(Contract NAS8-32036)
(NASA-CR-150522; IBM-77W-0061) Avail: NTIS HC A04/MF A01 CSCL 10A

The space and domestic water solar heating system designated SIMS Prototype Systems 1 was evaluated. The test system used 720 ft (gross) of Solar Energy Products Air Collectors, a Solar Control Corporation SAM 20 Air Handler with Model 75-175 control unit, a Jackson Solar Storage tank with Rho Sigma Mod 106 controller, and 20 tons of rack storage. The test data analysis performed evaluates the system performance and documents the suitability of SIMS Prototype System 1 hardware for field installation. Author

N78-18528*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ANALYSIS OF REQUIREMENTS FOR ACCELERATING THE DEVELOPMENT OF GEOTHERMAL ENERGY RESOURCES IN CALIFORNIA
C. D. Fredrickson 3 Mar. 1978 178 p
(Contract NAS7-100)
(NASA-CR-155782; JPL-Pub-77-63) Avail: NTIS HC A09/MF A01 CSCL 10B

Various resource data are presented showing that geothermal energy has the potential of satisfying a singificant part of California's increasing energy needs. General factors slowing the development of geothermal energy in California are discussed and required actions to accelerate its progress are presented. Finally, scenarios for developing the most promising prospects in the state directed at timely on-line power are given. Specific actions required to realize each of these individaul scenarios are identified. Author

N78-18529# Union Coll., Schenectady, N.Y.
EFFECTS OF ENERGY CONSTRAINTS ON TRANSPORTATION SYSTEMS
Ram K. Mittal, ed. Dec. 1977 559 p refs Presented at the 4th Natl. Conf. held at Union College, Schenectady, N. Y., 1-5 Aug. 1977
(Contract EC-77-G-01-60-67)
Avail: NTIS HC A24/MF A01

Energy conservation policies and methods are reviewed for

all phases of the transportation industry, including ships, aircraft, trucks, automobiles, and rail transportation. Electrification and synthetic fuels are also considered. For individual titles, see N78-18530 through N78-18555.

N78-18530# Bureau of Mines, Washington, D. C. Div. of Interfuels Studies.
THE UNITED STATES ENERGY SCENE 1976-1985
Walter G. Dupree, Jr. *In* Union Coll. Effects of Energy Constraints on Transportation Systems Dec. 1977 p 1-32 refs (For availability see N78-18529 09-44)
Avail: NTIS HC A24/MF A01

The prospective energy condition of the United States is considered. Various energy sources are discussed, along with their possible cost and longevity. Crude oil, natural gas, and coal resources are emphasized. J.A.M.

N78-18531# Bureau of Mines, Washington, D. C. Div. of Interfuels Studies.
ENERGY CONSUMPTION IN THE TRANSPORTATION SECTOR
Walter G. Dupree, Jr. *In* Union Coll. Effects of Energy Constraints on Transportation Systems Dec. 1977 p 33-60 refs (For availability see N78-18529 09-44)
Avail: NTIS HC A24/MF A01

A historical background is provided, regarding the percent of energy consumed and the types of energy consumed by the U.S. transportation sector. It was concluded that the transportation sector accounted for nearly 25 percent of the energy consumption over the last quarter of a century. During the same time period, its share of petroleum usage has risen from 78.5 percent to 96.9 percent. In 1950, coal usage was nearly 20 percent; it is now negligible. It was also concluded that the transportation sector uses nearly 50 percent of the total petroleum consumed in the U.S. The consumption of petroleum products (liquified gases, jet fuel, gasoline, distillate fuel, residual fuel and lubes and waxes) by the transportation sector has shown some variation over time. Author

N78-18532# New York State Dept. of Transportation, Albany.
LONG RANGE TRANSPORTATION PLANNING UNDER ENERGY CONSTRAINTS: A CRITICAL REVIEW OF CURRENT CAPABILITY
David T. Hartgen *In* Union Coll. Effects of Energy Constraints on Transportation Systems Dec. 1977 p 49-60 refs (For availability see N78-18529 09-44)
Avail: NTIS HC A24/MF A01

Central issues for continuing planning were identified as: (1) reevaluation of long-range plans; (2) modal alternatives; (3) investment needs; and (4) funding flow. The UTPS process was found to be capable of dealing quite well with certain energy policies (e.g., speed reductions, increased vehicle efficiency) but was generally a weaker tool in addressing other policies (e.g., rationing, Sunday driving bans, urban activity redistribution). Generally, the sensitivity analysis capability of UTPS appeared stronger than its capability to predict actual impacts. Specific information on gasoline price elasticity of travel by trip purpose, as well as trip priorities would greatly increase the predictive power of the system. Author

N78-18533# Texaco, Inc., Beacon, N. Y. Environmental Protection Dept.
OPTIMIZATION OF THE VEHICLE-FUEL-REFINERY SYSTEM
W. T. Tierney and R. F. Wilson *In* Union Coll. Effects of Energy Constraints on Transportation Systems Dec. 1977 p 61-80 refs (For availability see N78-18529 09-44)
Avail: NTIS HC A24/MF A01

It was concluded that system optimizations similar to the VFR system study must be more broadly applied between the various energy sources and final use devices to improve conservation in the entire spectrum of energy utilization. Author

N78-18534# Massachusetts Inst. of Tech., Cambridge.
ALTERNATIVE AUTOMOTIVE ENGINES AND ENERGY CONSERVATION
Lawrence H. Linden *In* Union Coll. Effects of Energy Constraints on Transportation Systems Dec. 1977 p 81-114 refs Repr. from Energy and Transportation, SAE-SP-406, Feb. 1976 (For availability see N78-18529 09-44)
(Grant NSF PRA-76-81015)
Avail: NTIS HC A24/MF A01

While substantial savings can be expected in automobile energy consumption, the contributions towards these savings from alternative engines is not clear. Two issues are discussed: one pertains to uncertainties in current estimates of the benefits to be gained from alternative power-plants, and the other pertains to uncertainties in the role of the automobile in the industry's process of technological innovation. Thus, while the case was made that some of the more promising alternative engines offered the potential for significant savings in automotive fuel consumption, and were therefore options worth pursuing, the case was also made that these savings might be realized without the introduction of alternatives and the upheaval such introduction would bring. Author

N78-18535# SRI International Corp., Menlo Park, Calif. Center for Resource and Environmental Systems Studies.
SYNTHETIC LIQUID FUELS DEVELOPMENT: ASSESSMENT OF CRITICAL FACTORS
Barry L. Walton *In* Union Coll. Effects of Energy Constraints Dec. 1977 p 115-140 refs (For availability see N78-18529 09-44)
Avail: NTIS HC A24/MF A01

The study related to the technology assessment of selected liquid fuels derived from coal and oil shale. These fuels were considered to be the most likely alternatives to substitute for/or augment petroleum derived fuels in the transportation sector in the 1980-2000 time frame. The core of the study deals with the preparation of maximum credible implementation (MCI) scenario for the deployment of a synthetic liquid fuel industry based on the use of coal and oil shale to produce synthetic crude oils and methanol. The preparation of the MCI was followed by detailed exploration of the broad consequences if the scenario were to become a reality. Author

N78-18536# Pennsylvania Univ., Philadelphia.
ENERGY USE IN INTERCITY FREIGHT TRANSPORT AND POLICY IMPLICATIONS
Edward K. Morlok *In* Union Coll. Effects of Energy Constraints on Transportation Systems Dec. 1977 p 141-158 refs (For availability see N78-18529 09-44)
Avail: NTIS HC A24/MF A01

The study included rail movement in conventional cars, rail movement in truck trailers on flat cars (TOFC or piggyback), and over the road movement in various types of trailer trucks. Characteristics such as weight and size of shipments, the average speed, and route profile conditions were varied. In order to identify the effects of varying mode and market characteristics, the work requirements (foot-pounds) were estimated using engineering relationships in contrast to most prior comparisons which have used average empirical (statistical) data. The study concluded that route profile had a considerable effect on the propulsive work required. In general, the truck was least affected by undulating profiles and relatively large average and ruling grades, while both TOFC and conventional rail were very adversely affected. Author

N78-18537# Peat, Marwick, Mitchell and Co., Washington, D. C.
ENERGY AND ECONOMIC IMPACTS OF PROJECTED FREIGHT TRANSPORTATION IMPROVEMENTS
Robert H. Leilich *In* Union Coll. Effects of Energy Constraints on Transportation Systems Dec. 1977 p 159-180 ref (For availability see N78-18529 09-44)
Avail: NTIS HC A24/MF A01

The major goal was to estimate the current and future energy intensity for major freight modes. The economic impact of anticipated changes in freight systems (trucks, railroads, inland waterways, coastal and Great Lakes ships, pipe lines, and air freight) under various assumptions about freight demands for 1980 and 1985. The impact of certain vehicle types upon energy intensity was also examined. Statistical and engineering relationships were used for predicting the energy usage and intensity. The study was constrained by the nonavailability of good energy related data. It was highly recommended that attempts should

be made to collect data which could enhance future studies related to energy conservation. Author

N78-18538# Cummins Engine Co., Inc., Columbus, Ind.
TRUCKING AND FUEL ECONOMY
David B. Stattenfield *In* Union Coll. Effects of Energy Constraints on Transportation Systems Dec. 1977 p 181-196 (For availability see N78-18529 09-44)
Avail: NTIS HC A24/MF A01

Heavy duty trucks for freight movement are discussed in terms of energy and economic aspects. The recoverable and nonrecoverable aspects of energy were quantified ways of minimizing energy consumption. Considerable emphasis is placed on operational aspects which may provide some insights towards reducing the energy consumption in the intercity trucking industry. The simulation approach was demonstrated as a design tool for the selection of the optimum truck under given conditions. Details of the truck components (engine, transmissions, driving axles, tires) were provided. Author

N78-18539# Federal Highway Administration, Washington, D.C. Highway Statistics Div.
ESTIMATED HIGHWAY FUEL SAVINGS IN 1975
W. Johnson Page, Alexander French, and Joseph E. Ullman *In* Union Coll. Effects of Energy Constraints on Transportation Systems Dec. 1977 p 197-213 refs (For availability see N78-18529 09-44)
Avail: NTIS HC A24/MF A01

An analysis of the effectiveness of efforts to conserve motor fuel is presented, using data available through 1975. All states now have a 55 mph speed limit. This study attempted to answer the following set of questions: Did the energy crisis have a lasting effect in changing travel patterns and driving habits or are we back to business as usual, now that fuel is readily available again? Has there been any change in car pooling and public transportation patterns during the peak hours? How much has fuel consumption been affected by the increased proportion of smaller cars in the vehicle mix and the greater fuel efficiency of the more recent model year cars? Author

N78-18540*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AIR TRANSPORTATION ENERGY EFFICIENCY
Louis J. Williams *In* Union Coll. Effects of Energy Constraints on Transportation Systems Dec. 1977 p 215-239 refs (For availability see N78-18529 09-44)
Avail: NTIS HC A24/MF A01 CSCL 10B

The energy efficiency of air transportation, results of the recently completed RECAT studies on improvement alternatives, and the NASA Aircraft Energy Efficiency Research Program to develop the technology for significant improvements in future aircraft were reviewed. Author

N78-18541# Urban Mass Transportation Administration, Washington, D.C.
THE ENERGY EFFICIENCY OF URBAN TRANSIT SYSTEMS
H. Lee Tucker *In* Union Coll. Effects of Energy Constraints on Transportation Systems Dec. 1977 p 241-262 refs (For availability see N78-18529 09-44)
Avail: NTIS HC A24/MF A01

The energy consumption and efficiency were evaluated for urban automobile, bus, rail rapid, light rail and Automated Guideway Transit (AGT) modes. Transportation profiles are reviewed and the portion of total energy used by urban transit systems is identified. This was followed by an overview of the energy intensiveness of urban transit systems and the extent that each mode was used in the United States. The major components of operating and construction energy are listed and evaluated for each transit mode. Energy intensiveness estimates were then computed and normalized on the basis of recent system lifetime data (in terms of vehicle miles). Energy intensiveness is presented in terms of passenger seat miles where the effect of load factors on transit energy efficiency is treated parametrically due to the variability in load factor reference data. Author

N78-18542# Congressional Budget Office, Washington, D. C.
PRESIDENT CARTER'S AUTOMOBILE RELATED ENERGY CONSERVATION PROPOSALS
Damian J. Kulash *In* Union Coll. Effects of Energy Constraints on Transportation Systems Dec. 1977 p 263-304 refs (For availability see N78-18529 09-44)
Avail: NTIS HC A24/MF A01

The energy conservation proposals were directed towards: (1) encouraging the manufacture and purchase of cars that are more fuel efficient through a system of taxes and rebates that would make more efficient cars cheaper and less efficient cars more expensive for the buyer; and (2) encouraging people to drive fewer miles by imposing taxes that would raise the price of gasoline. The study concludes that the gas guzzler excise taxes would have the largest effect on fuel consumption. At the same time, its effect on total car sales should be relatively minor, reaching a maximum reduction of about 280,000 new cars sold in 1985. As a whole, the President's proposals would reduce gasoline consumption by about 55,000 and 305,000 barrels per day in 1980 and 1985, respectively. Author

N78-18543# Ford Motor Co., Dearborn, Mich. Automotive Emissions and Fuel Economy Office.
POTENTIAL FOR AUTOMOTIVE FUEL ECONOMY IMPROVEMENT
Clay W. LaPointe *In* Union Coll. Effects of Energy Constraints on Transportation Systems Dec. 1977 p 305-316 (For availability see N78-18529 09-44)
Avail: NTIS HC A24/MF A01

Various facets of the automotive fuel economy program were discussed. Auto makers under the enactment of the 'Energy Policy and Conservation Act' have to come up with a fleet average fuel economy of 27.5 mpg by 1985. The impact of various driving cycle approaches upon fuel economy were explained. Several components of work (rolling friction, aerodynamics, inertia, etc.) were examined in relation to the types of the driving cycle. An analysis of the methodology utilized behind the estimation of the rolling and aerodynamic resistance was provided. Data related to aerodynamic drag coefficient were provided for several cars and vans. A set of potential improvement actions which included: (1) reduction in weight of 20 percent with a fuel economy improvement in the range of 13-16 percent; and (2) stratified charge engine (high compression) which may improve efficiency by 20 percent were outlined. Author

N78-18544# Federal Railroad Administration, Washington, D. C.
OUTLINE OF THE ENERGY-RELATED PROJECTS SPONSORED BY THE FEDERAL RAILROAD ADMINISTRATION, DOT
John Koper *In* Union Coll. Effects of Energy Constraints on Transportation Systems Dec. 1977 p 317-327 ref (For availability see N78-18529 09-44)
Avail: NTIS HC A24/MF A01

An overview of the energy related projects sponsored by the Office of Research and Development, FRA, DOT was given. An organizational chart with FRA was provided. It lists the specifics of the study in relation to fuel measurement of freight trains. The details of a study related to flywheel energy storage for classification yard switch locomotives were also listed. The 'Rail Electrification Study' which is examining the potential National benefits of electrifying the high density rail-lines, was examined. Author

N78-18545# Transportation Systems Center, Cambridge, Mass.
MEASUREMENT AND SIMULATION OF FUEL CONSUMPTION IN RAIL FREIGHT SERVICE
John B. Hopkins *In* Union Coll. Effects of Energy Constraints on Transportation Systems Dec. 1977 p 329-340 (For availability see N78-18529 09-44)
Avail: NTIS HC A24/MF A01

Fuel consumption measurements were carried out in cooperation with several railroads for a variety of types of revenue freight service. Intermodal operations were emphasized. Studies relating to branchline and general freight movements were also included. The wide range of operating parameters examined include train speed, weight, length, type, power to weight ratio, and terrain. In particular, the test conditions, operating parameters and fuel usage indices for 85 separate line haul movements on six different railroads, covering 52,700 train miles were de-

scribed. In spite of considerable variation in relevant parameters and inherent imprecision in the data, the results are found to exhibit a basic consistency both internally and with past estimates. Author

N78-18546# Aerospace Corp., Los Angeles, Calif. Energy and Transportation Div.
INTERCITY RAIL ENERGY INTENSITY FOR PASSENGER MOVEMENT
Ram K. Mittal *In* Union Coll. Effects of Energy Constraints on Transportation Systems Dec. 1977 p 341-372 refs (For availability see N78-18529 09-44)
Avail: NTIS HC A24/MF A01

The impacts of operating conditions (speed, trip-length, load factor) and train-consists were studied. An extensive list of data used for evaluation purposes was documented. Impact of track on energy intensity is also examined. Several trains were simulated along the New York City to Buffalo Corridor. Increases in energy efficiency due to modernization of rolling stock and improvements of track and service conditions were also analyzed to insure equitable comparision among the competitive modes. It is concluded that, presently the energy intensity figures are high because the load factor is low, and there is a considerable potential for improving EI values by improving the attractiveness of the trains and also by using the contemporary rolling stocks. It is also concluded that improved track is the key for rehabilitation of the railroads in the United States. Electric trains were also studied and proved from an energy intensity viewpoint. A comprehensive study in the subject area of electric trains was represented. A comparative analysis of the 'EI' values of the intercity passenger transportation modes was also presented. Energy intensity values of several train-consists were provided in a tabular form. Author

N78-18547# Massachusetts Inst. of Tech., Cambridge.
A STUDY OF THE ENERGY CONSEQUENCES OF ALTERNATIVE TRANSPORT POLICIES IN INTERCITY FREIGHT MARKETS
Paul O. Roberts *In* Union Coll. Effects of Energy Constraints on Transportation Systems Dec. 1977 p 373-398 (For availability see N78-18529 09-44)
Avail: NTIS HC A24/MF A01

The supply demand equilibrium problem was examined from the demand viewpoint, and alternative transport policies were evaluated. The freight market and policies were studied as well as logistic cost functions, and inventory control as a part of the logistics process. Basic concepts of a demand model were described and examined in detail. B.B.

N78-18548# Federal Energy Administration, Washington, D. C. Office of Conservation and Environment.
FEDERAL POLICY OPTIONS TO EFFECT FUEL CONSERVATION IN THE AIR INDUSTRY
Robert L. Bowles *In* Union Coll. Effects of Energy Constraints on Transportation Systems Dec. 1977 p 399-408 (For availability see N78-18529 09-44)
Avail: NTIS HC A24/MF A01

Federal policies which may have potential for reducing petroleum consumption within the transportation sector are presented. Airlines consume nearly 10 percent of the transportation energy and constitute a considerable portion of the operating cost. Federal policies discussed include: (1) Fuel Allocation and Price Control; (2) Taxation; (3) Air Carrier Regulation; (4) Aviation System Regulation and (5) Federal Expenditures and Investment. Author

N78-18549# Bureau of Economic Analysis, Washington, D. C.
MEASURING THE IMPACT ON SCHEDULED AIR LINES OPERATIONS OF RESTRICTIONS IN FUEL AVAILABILITY
J. C. Constanz *In* Union Coll. Effects of Energy Constraints on Transportation Systems Dec. 1977 p 409-416 (For availability see N78-18529 09-44)
Avail: NTIS HC A24/MF A01

Airline and aircraft manufacturers' fuel conservation efforts are presented. A description was given of how since 1973, passengers flown per gallon of fuel used have increased by 19 percent. The airline reduced the average number of flights flown each day to conserve fuel and to take advantage of more efficient aircraft which carry more passengers per flight. Use of computerized flight plans (optimum routes, altitudes and speeds) reduced the use of fuel to a considerable extent. Use of flight simulators and fewer engines during taxiing reduced the consumption of petroleum. Author

N78-18550# General Electric Co., Erie, Pa. Transportation Systems Business Div.
ELECTRIFICATION OF RAILROADS PROBLEMS-POTENTIALS-ECONOMIC IMPACTS
Merlin D. Meeker *In* Union Coll. Effects of Energy Constraints on Transportation Systems Dec. 1977 p 417-438 refs (For availability see N78-18529 09-44)
Avail: NTIS HC A24/MF A01

A historical background of railroad electrification within the United States was given. Data related to percent electrification of railroad route miles within the major developed countries around the world were presented. An attempt was made to provide quantification of the benefits accrued due to electrification. The economic and technical characteristics between the diesel/electric and electric trains were compared. The following aspects of electrification were considered: electric locomotives have: 2/3 lower maintenance; twice economic life, and 1/2 the out of service time. Also listed were the components of cost for electrification and data were provided on the rate of return estimated under several scenarios. Author

N78-18551# General Research Corp., Santa Barbara, Calif.
ELECTRIC CAR TECHNOLOGY FOR DEMONSTRATION AND DEVELOPMENT
William Hamilton *In* Union Coll. Effects of Energy Constraints on Transportation Systems Dec. 1977 p 439-456 (For availability see N78-18529 09-44)
Avail: NTIS HC A24/MF A01

The performance characteristics of the electric cars which were developed around the world were characterized. It was reported that the acceleration capability of the electric cars is sluggish in comparison with the conventional ICE engines. Comprehensive data on the elements of operating cost as a function of the service characteristics were provided. It concluded that the future potential of electric automobiles depends mainly upon battery development. Batteries have always imposed critical technical limitations on the range and speed of electric cars. There has been relatively little progress in propulsion batteries compared with improvements in ICE auto technology. The battery improvements are a prerequisite towards the introduction of electric cars in the urban arena. Life cycle cost per kilometer versus range were documented for several types of electric cars and compared with the conventional ICE car. Changes in fuel prices could reduce or eliminate the cost disadvantages of the electric cars. Author

N78-18552# General Research Corp., Santa Barbara, Calif.
URBAN APPLICATIONS AND ENERGY IMPACTS OF FUTURE ELECTRIC CARS
William Hamilton *In* Union Coll. Effects of Energy Constraints on Transportation Systems Dec. 1977 p 457-471 (For availability see N78-18529 09-44)
Avail: NTIS HC A24/MF A01

The potential applications of the electric cars within the urban arena were documented. Driving patterns within urban areas were studied. Based upon these patterns, data related to range for electric cars were examined. It is concluded that a range of 72 kilometers is within the reach of present technology, and easily achievable with technology expected in the coming decade. Yet it suffices for 17% of urban cars. Data were also provided for energy requirements of prospective electric cars. Projected petroleum savings as a function of future use of electric cars in Los Angeles, Philadelphia, and St. Louis are also provided. The petroleum savings are in the range of 2-8% of national oil use which appears to be a modest portion of the total U.S. petroleum used. It is also concluded that the substitution of electric cars might substantially reduce exposure of urban populations to excessive traffic noise. The life-cycle costs between subcompact cars are compared with electric cars and it is stated that the electric cars are 20 - 50% higher than those of the conventional car. Author

N78-18553# Energy Research and Development Administration, Washington, D. C.
ERDA FUNDING IN TRANSPORTATION ENERGY CONSERVATION AREA AND RESEARCH PLANS
Gene Mannella *In* Union Coll. Effects of Energy Constraints on Transportation Systems Dec. 1977 p 473-484j (For availability see N78-18529 09-44)
Avail: NTIS HC A24/MF A01

Several facets of the Transportation Energy Conservation Program pursued by ERDA are presented. The program elements were divided into three categories: (1) Electric and Hybrid Vehicles: (2) Highway Systems; and (3) NonHighway Transport and Special Projects. The Highway System Program is directed towards improving propulsion system and researching alternative fuels. As part of the improvements towards propulsion systems, ERDA is undertaking research related to gas turbine engines and Stirling engines. ERDA plans to have demonstration models fitted with Stirling and gas turbine engines by 1982 with a view to decide on future R&D strategies. The NonHighway Transport Energy Conservation Program was directed towards: development and demonstration of energy saving technologies and operational strategies; encourage near term energy savings through improved operations and new concepts evaluation; define and assess environmental, socio-economic, institutional and other potential impacts. Author

N78-18554# Oak Ridge National Lab., Tenn.
DATA NEEDS IN TRANSPORTATION ENERGY CONSERVATION RESEARCH
T. Patrick OConnor and Andrew Loebl *In* Union Coll. Effects of Energy Constraints on Transportation Systems Dec. 1977 p 485-504 refs (For availability see N78-18529 09-44)
Avail: NTIS HC A24/MF A01

An overview of the subject of data needs in transportation energy conservation research is presented. The discussion focuses upon data which are needed for analysis of economic, social and technological factors which determine energy consumption and conservation aspects in the transportation sector. It is conceived that credible information related to energy supply and demand will help to facilitate a consensus about United States energy policy. Data needs which relate to patterns of energy consumption in the transportation sector were identified. Most of the topics discussed call for research in addition to data collection. It is concluded that tremendous deficiencies exist in regard to data needs for planning transportation systems under the current petroleum constraints. Author

N78-18555# Aerospace Corp., Los Angeles, Calif. Energy and Transportation Div.
ENERGY INTENSITY OF VARIOUS TRANSPORTATION MODES
Ram K. Mittal *In* Union Coll. Effects of Energy Constraints on Transportation Systems Dec. 1977 p 505-536 refs (For availability see N78-18529 09-44)
Avail: NTIS HC A24/MF A01

An overview of the existing literature related to Energy Intensity (EI) of various transportation modes is presented. These transportation modes include intracity (auto, bus, automated guideway transit system, vans, heavy rail, and light rail transit), and intercity (airplanes, autos, buses, trucks, rail, waterways and pipelines) modes of transportation for passenger and freight movement. Wherever possible, an attempt was made to correlate energy intensity as a function of operating conditions such as speed, load factor, type of commodities being moved, etc. Use of both statistical and engineering approaches were made for estimating energy intensity figures. It is concluded that energy intensity values have a considerable range depending upon the operating conditions, types of hardware, trip characteristics, load factor and type of commodities being shipped. The major output of the study is a list of suggested EI values (in tabular form) for several transportation modes. Guidelines are also provided for furthering the state of the art related to energy intensity work. Author

N78-18556# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
THEORY OF WIND TURBINES WITH CONTRAROTATION
G. N. Patterson Jul. 1977 31 p refs
(UTIAS-218; CN-ISSN-0082-5255) Avail: NTIS HC A03/MF A01

Emphasis was placed on a ducted contrarotating system of high efficiency capable of a wide range of operating conditions. The report includes: (1) flow conditions; (2) blade element theory; (3) slipstream rotation between rotors and overall efficiencies; and (4) efficiency and the lift drag ratio. A procedure was suggested for the aerodynamic design of the system. J.C.S.

N78-18557# Rome Air Development Center, Griffiss AFB, N.Y.
RADIATION EFFECTS ON AlGaAs/GaAs SOLAR CELLS USING 0.9-3.0 MeV PROTONS AND 1.0-1.4 MeV ELECTRONS Technical Report, 1 Jan. - 31 Dec. 1976
L. F. Lowe, J. R. Cappelli, L. W. James, and R. L. Moon Sep. 1977 35 p
(AD-A048037; RADC-TR-77-332) Avail: NTIS HC A03/MF A01 CSCL 10/2

Aluminum gallium arsenide solar cells were irradiated with 1.0 and 1.4 MeV electrons, and with 0.9 and 3.0 MeV protons to determine radiation sensitivity. Electron fluences ranged from 1 x 10 to the 14th power to 3 x 10 to the 16 power electrons, 1 sq cm, and proton fluences from 5 x 10 to the 10 power to 2.7 x 10 to the 12th power/sq cm. A solar simulator and a tungsten lamp were used to evaluate changes in the current-voltage characteristics curves. In most cases, AlGaAs solar cells showed a greater resistance to radiation than silicon cells. GRA

N78-18558*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMPUTER PROGRAM FOR DESIGN AND PERFORMANCE ANALYSIS OF NAVIGATION-AID POWER SYSTEMS. PROGRAM DOCUMENTATION. VOLUME 1: SOFTWARE REQUIREMENTS DOCUMENT Final Report
G. Goltz, L. M. Kaiser, and H. Weiner Jul. 1977 182 p
(AD-A047925; JPL-5040-27-Vol-1; USCG-D-11-77-Vol-1; CGR/DC-18/76-Vol-1) Avail: NTIS HC A09/MF A01 CSCL 09/2

A computer program has been developed for designing and analyzing the performance of solar array/battery power systems for the U.S. Coast Guard Navigational Aids. This program is called the Design Synthesis/Performance Analysis (DSPA) Computer Program. The basic function of the Design Synthesis portion of the DSPA program is to evaluate functional and economic criteria to provide specifications for viable solar array/battery power systems. The basic function of the Performance Analysis portion of the DSPA program is to simulate the operation of solar array/battery power systems under specific loads and environmental conditions. This document establishes the software requirements for the DSPA computer program, discusses the processing that occurs within the program, and defines the necessary interfaces for operation. GRA

N78-18559# Stanford Univ., Calif. Center for Materials Research.
SOLID ELECTROLYTE BATTERY MATERIALS Final Report, 1 Jul. 1976 - 31 Sep. 1977
Robert A. Huggins Nov. 1977 16 p refs
(Contract N00014-76-C-0940)
(AD-A048330; CMR-77-15) Avail: NTIS HC A02/MF A01 CSCL 07/4

This is the final report on this contract. Work involved the preparation of lithium nitride and a number of other potential ionic conductors and mixed ionic-electronic conductors. Most attention was given to lithium ionic conductors. Crystal structure information was obtained, and measurements made of ionic conductivity and other relevant properties. Author (GRA)

N78-18560# Kentucky Univ., Lexington. Inst. for Mining and Minerals Research.
CLEAN COAL COMBUSTION THROUGH COAL WASHING AND BLENDING
O. W. Stewart and J. K. Shou May 1977 27 p
(PB-274406/8; IMMR29-PD18-77) Avail: NTIS HC A03/MF A01 CSCL 08I

Investigative work directed to the beneficiation of Kentucky coals is presented. General property analysis, pyritic sulfur reduction by the float-sink method, combustion characteristics of selected coals and coal blends, and characteristics of resulting ash were studied. The technical and economical aspects of high

sulfur coal utilization through blending and washing, and stack gas cleanup strategies are discussed. GRA

N78-18561# Rensselaer Polytechnic Inst., Troy, N. Y.
FOCUSING SOLAR COLLECTOR DEVELOPMENT Final Report
W. E. Rogers, D. N. Borton, and A. A. Burr Jul. 1977 78 p
(PB-275042/0; NYSERDA-75/34) Avail: NTIS HC A05/MF A01 CSCL 10A

Design modifications and engineering tests on a dual tracking focusing solar collector concept are discussed. The 360 square foot concentrator was constructed to evaluate performance of a heliostat design and of receivers at its focus, as well as to ascertain characteristics of insolation at the site. GRA

N78-18562# BDM Corp., Vienna, Va.
PRELIMINARY ANALYSIS OF AN OPTION FOR THE FEDERAL PHOTOVOLTAIC UTILIZATION PROGRAM
Orin H. Merrill, J. C. Belote, Mary R. Hamilton, J. Scott Hauger, and Judy Israel Nov. 1977 59 p refs
(PB-274220/3; HCP/L4965-0001) Avail: NTIS HC A04/MF A01 CSCL 10B

The intention of the program is to provide significant, cost effective incentive for the accelerated development of an innovative highly competitive industry capable of producing low cost, quality, photovoltaic systems. This industry would be capable of supplying the private sector with a major source of clean, nondepletable electrical energy. As a secondary benefit, the Federal government is expected to realize significant net cost savings. The option analyzed in this report would consist of a series of Federal procurements resulting in the installation of 152 megawatts peak of photovoltaic arrays over a five year period. GRA

N78-18563# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Space Simulation Inst.
THERMAL CYCLING TESTS ON SOLAR CELL PANEL SAMPLES UNDER VACUUM CONDITIONS Final Report
W. Ley Paris ESA Jan. 1977 102 p refs
(Contract ESTEC-2311/74-AK)
(DLR-IB-353-77/1; ESA-CR(P)-1012) Avail: NTIS HC A06/MF A01

A test facility was used for comparative deep thermal cycling tests under vacuum conditions on eight different solar cell panel samples delivered by three European manufacturers. During 2500 temperature cycles (hot phase - maximum temperature +70 C; cold phase - minimum temperature -180 C) four rigid and four flexible solar cell panels were tested simultaneously. At room temperature the samples were investigated at predetermined intervals for optical, electrical, and mechanical differences. The test facility is described in detail and the test results obtained are discussed. Author (ESA)

N78-18564# Federal Energy Administration, Washington, D. C. Strategic Petroleum Reserve Office.
OTHER STORAGE RESERVE REPORT
16 Aug. 1977 72 p
(PB-273474/7; FEA/S-77/359) Avail: NTIS HC A04/MF A01 CSCL 21D

Recommendations were set forth concerning the necessity for, and feasibility of, establishing: (1) Utility Reserves containing coal residual fuel oil, and refined petroleum products, to be established and maintained by major fossil fuel fired baseload electric power generating stations; (2) Coal Reserves to consist of (a) Federally owned coal which is mined by or for the United States from Federal lands, and (b) Federal lands from which coal could be produced with minimum delay; and (3) Remote Crude Oil and Natural Gas Reserves consisting of crude oil and natural gas to be acquired and stored by the United States. Author

N78-18565# Institute of Gas Technology, Chicago, Ill.
PILOT PLANT STUDY OF CONVERSION OF COAL TO LOW SULFUR FUEL Final Report, Jun. 1973 - Mar. 1975
Donald K. Flemming and Robert D. Smith Oct. 1977 156 p refs
(Contract EPA-68-02-1366)
(PB-274113/0; EPA-600/2-77-206) Avail: NTIS HC A08/MF A01 CSCL 07A

Results are given of a program to develop, on bench and pilot scales, operating conditions for the key step in the process to desulfurize coal by thermal and chemical treatment. This process used the 'sulfur-getter' concept. (A sulfur-getter was a material that had a greater chemical affinity for sulfur than coal had.) Lime was the sulfur-getter for this program. GRA

N78-18566# PEDCO-Environmental Specialists, Inc., Cincinnati, Ohio.
PRELIMINARY EVALUATION OF SULFUR VARIABILITY IN LOW-SULFUR COALS FROM SELECTED MINES
A. Carl Nelson Nov. 1977 157 p refs
(Contract EPA-68-02-1321)
(PB-275000/8; EPA-450/3-77-044) Avail: NTIS HC A08/MF A01 CSCL 21E

Data on the variability of sulfur content and heating value of coal were obtained from several coal and utility companies and analyzed to estimate the mean, standard deviation, and the frequency distribution of weight percent sulfur and the impact of this variability on the required average sulfur content to comply with an emission regulation. In order to assess the implications of sulfur variability for compliance with emission regulations, the relative standard deviation (RSD) of weight percent sulfur was estimated. These RSD's were used to estimate the required average sulfur content to yield 95 and 99 percent compliance with the emission limitations of 1.2 lb SO2/MM Btu. GRA

N78-18567# National Bureau of Standards, Washington, D. C. Office of Building Standards and Codes Services.
STATE SOLAR ENERGY LEGISLATION OF 1976: A REVIEW OF STATUTES RELATING TO BUILDINGS Final Report
Robert M. Eisenhard Sep. 1977 258 p refs Sponsored by ERDA and HUD
(PB-273899/5; NBSIR-77/12) Avail: NTIS HC A12/MF A01 CSCL 10A

State legislation on solar energy use in buildings enacted in 1976 was reviewed. Acts involve tax incentives for the installation of solar devices, support for the proposed Solar Energy Research Institute, solar standards, state energy offices, studies, building requirements and solar projects. The Acts were identified and abstracted, and responsible state officials were listed. GRA

N78-18568# American Society of International Law, Washington, D. C.
OCEAN THERMAL ENERGY CONVERSION: LEGAL, POLITICAL, AND INSTITUTIONAL ASPECTS
H. Gary Knight, ed., J. D. Nyhart, ed., and Robert E. Stein, ed. 1977 255 p refs
(Grant NSF AER-75-00280-A02)
(PB-274123/9; ISBN-0-669-01441-9; NSF/RA-770273; LC-77-2049) Avail: NTIS MF A01 CSCL 10B

An overview of nonlegal issues, including the technical background of OTEC plants and an economic assessment of OTEC are presented. Also presented is an evaluation of the international legal aspects; international political implications of OTEC systems; spatial and emerging use conflicts of ocean space; international regulatory authority concerning OTEC devices; and international environmental aspects. GRA

N78-19041*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A LOW COST HIGH TEMPERATURE SUN TRACKING SOLAR ENERGY COLLECTOR
Gerald S. Perkins *In* NASA. Goddard Res. Center The 11th Aerospace Mech. Symp. Apr. 1977 p 157-169 (For availability see N78-19026 09-99)
(Contract NAS7-100)
Avail: NTIS HC A11/MF A01 CSCL 10A

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N78-18569 Purdue Univ., Lafayette, Ind.
MULTIVARIATE ANALYSIS OF ATMOSPHERIC PARTICULATE COMPOSITION AND COMPUTER-CONTROLLED

INTERFERENCE CORRECTION FOR ION-SELECTIVE ELECTRODE MEASUREMENTS IN A FLOWING STREAM Ph.D. Thesis
Phillip Dale Gaarenstroom 1977 201 p
Avail: Univ. Microfilms Order No. 77-30078

Aspects of analytical measurements in multicomponent systems are considered. First, data analysis techniques useful for discerning the interrelationships among species being monitored in a dynamic many-component system were examined. Secondly, accurate measurements were made with ion-selective electrodes in the presence of high concentrations of interfering ions. Two real multicomponent systems were studied in order that the general methodologies could be developed and applied. Data analysis of chemical measurements made on atmospheric particulates collected in the southwestern desert environment are described. The experimental procedure developed for making simultaneous multiple ion-selective electrode determinations was delineated with results for sodium and potassium determinations over a wide concentration range. Design considerations for computer-controlled instrumentation are discussed.
Dissert. Abstr.

N78-18570 Maryland Univ., College Park.
SIZE AND COMPOSITION OF ATMOSPHERIC PARTICLES IN RURAL AREAS NEAR WASHINGTON, D. C. Ph.D. Thesis
Sally Campbell Thomae 1977 439 p
Avail: Univ. Microfilms Order No. 77-28007

Samples were analyzed for up to 27 elements using instrumental neutron activation analysis. Thirty-six samples of soil from the region were also analyzed. The annual average concentrations at the Frederick site for most elements are about 25 to 50% of the concentrations seen in Washington, D. C., with Br, V, Cr, Sc and Sb showing the largest reductions. Samples collected during a severe inversion in the Hagerstown Valley showed elemental concentrations almost identical to those seen in Washington, D. C. samples. Arsenic concentrations, however, were an order of magnitude higher in the Hagerstown region. The samples collected in Virginia during a severe air pollution alert showed unusually high concentrations of Zn, Se, Cr and Co, but not of Br or As. The rural aerosol was shown to have two components: (1) soil-like material containing blowing soil and fly-ash from coal combustion and (2) a fine-particle component carrying a large proportion of the elements As, Se, Sb, Zn, and Br, which usually have significant anthropogenic sources.
Dissert. Abstr.

N78-18571 Maryland Univ., College Park.
TRACE ELEMENTS IN WATER: A DEVELOPMENT AND APPLICATION OF SAMPLING AND SAMPLE HANDLING PROCEDURES Ph.D. Thesis
Sally Hart Harrison 1977 205 p
Avail: Univ. Microfilms Order No. 77-27997

For the collection of samples, a Teflon water sampler, with an attachment for direct filtration, was designed and constructed. The Teflon sampler was used in the determination of short-term concentration variations at a sampling site. Using both fresh water and estuarine locations (the Patuxent River and the Chesapeake Bay) it was found that elements known to exist in the ionic form, Na, Cl, etc., gave apparent variations in the filtrated samples approximately equal to the analytical error of the determinations. Other elements, primarily associated with suspended matter, Sc, Fe, Th, gave variable and high sampling variations in the filtrate samples, generally from 20% to 40%. Using the analytical technique of instrumental neutron activation analysis, multielement determination on both the freeze-dried filtrate and suspended particulate portions of the samples were obtained.
Dissert. Abstr.

N78-18572*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TRACE ELEMENTAL CHARACTERISTICS OF AEROSOLS EMITTED FROM MUNICIPAL INCINERATORS
Jag J. Singh Feb. 1978 31 p refs
(NASA-TM-78630; L-11913) Avail: NTIS HC A03/MF A01 CSCL 13B

As part of a continuing investigation of high temperature combustion aerosols, elemental composition of size differentiated aerosols emitted from a local municipal incinerator was studied. Aerosols were aerodynamically separated into eight diameter groups ranging from 0.43 mm to 20 mm, collected, and analyzed by charged particle induced X-ray emission technique. On line data collection and reduction codes generated aerial densities for elements from Na to U with sensitivities in the ng/cu m range for most elements. From the total weights of aerosols collected per stage, their size distribution was determined to be bimodal, with one group centered at a diameter of 0.54 mm and the other at a diameter of 5.6 mm. Measured elemental concentrations in various size ranges indicate that K and S show a strong tendency to concentrate on aerosol surfaces. A weaker trend for surface preference was also observed for Mn and Ni, but other elements show no such trend.
Author

N78-18573*# Cramer (H.E.) Co., Inc., Salt Lake City, Utah.
USERS' INSTRUCTIONS FOR THE NASA/MSFC CLOUD-RISE PREPROCESSOR PROGRAM, VERSION 6, AND THE NASA/MSFC MULTILAYER DIFFUSION PROGRAM, VERSION 6: RESEARCH VERSION FOR UNIVAC 1108 SYSTEM
J. R. Bjorklund Jan. 1978 233 p
(Contract NAS8-31841)
(NASA-CR-2945; M-245) Avail: NTIS HC A11/MF A01 CSCL 13B

The cloud-rise preprocessor and multilayer diffusion computer programs were used by NASA in predicting concentrations and dosages downwind from normal and abnormal launches of rocket vehicles. These programs incorporated: (1) the latest data for the heat content and chemistry of rocket exhaust clouds; (2) provision for the automated calculation of surface water pH due to deposition of HCl from precipitation scavenging; (3) provision for automated calculation of concentration and dosage parameters at any level within the vertical grounds for which meteorological inputs have been specified; and (4) provision for execution of multiple cases of meteorological data. Procedures used to automatically calculate wind direction shear in a layer were updated.
Author

N78-18574# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
INVESTIGATION OF REMOTE WATER-QUALITY MONITORING SYSTEMS FOR USE WITH GOES OR ERTS WATER DATA TRANSMITTER Final Report, Jul. - Dec. 1976
Alfred W. Ford Nov. 1977 50 p
(AD-A047795; WES-TR-Y-77-5) Avail: NTIS HC A03/MF A01 CSCL 17/2

A field demonstration was implemented to deploy under actual field conditions several water-quality monitoring systems to determine their overall suitability and compatibility with the LaBarge designed remote water data transmitter. In addition, the study was to establish an information base upon which decisions could be made for selecting water-quality monitoring equipment capable of gathering reliable data for extended periods with limited maintenance.
GRA

N78-18575# Army Medical Bioengineering Research and Development Lab., Fort Detrick, Md.
THE HAZARD RANKING AND ALLOCATION METHODOLOGY: ASSEMBLY OF THE HAZARD ESTIMATION DATA BASE FOR AIR AND SURFACE WATER POLLUTANTS Technical Report, Dec. 1976 - Aug. 1977
Mitchell J. Small Sep. 1977 46 p refs
(AD-A047826; USAMBRDL-TR-7713) Avail: NTIS HC A03/MF A01 CSCL 13/2

The Hazard Ranking and Allocation Methodology (HRAM) is a systematic approach to assist in the evaluation of potential research projects for munitions standards and installation restoration studies. HRAM is computer-executed. Hence, data inputs must be in a format compatible with program algorithms. This often involves a data translation or derivation from existing information. This report presents current methods for preparation of data inputs for chemical pollutants associated with air and surface water pollutants. In several cases where data sources are not available, starting estimates, or default values are

supplied. HRAM requires numerical declarations of the uncertainties associated with data inputs. Recommended values of these uncertainties are presented. Author (GRA)

N78-18576# Naval Postgraduate School, Monterey, Calif.
A COMPARATIVE STUDY OF THE COASTAL MARINE AEROSOL M.S. Thesis
Alan Anthony Simoncic Dec. 1977 112 p refs
(AD-A048673) Avail: NTIS HC A06/MF A01 CSCL 06/6

Aerosol size distributions near the coast of Panama City, Florida and off the Southern California coast near the Channel Islands are investigated in this study. The relationships of the coastal marine aerosol to wind speed, relative humidity, stability, and sub-synoptic circulation are examined. Relative humidity and stability are shown to have the largest effect on the aerosol distribution during periods of light winds. Coalescence and sedimentation of droplets greater than 1.5 micrometer radius are most pronounced when the wind speed and sea surface production of salt nuclei are weak. When wind speeds exceed 7 m/sec, a state of equilibrium between sedimentation and production of these larger droplets appears to exist. An apparent zone of transition between the two bubble bursting sea-salt producing mechanisms is observed near .5 micrometer radius. The highest correlation between wind speed and particle concentration occurs under unstable conditions. Secondary circulations are shown to be important determinants of the coastal marine aerosol in the absence of synoptic scale forcing.
Author (GRA)

N78-18577# Polytechnic Inst. of New York, Brooklyn. Dept. of Chemistry.
THE REMOVAL OF 2, 4, 6-TRINITROTOLUENE (TNT) FROM AQUEOUS SOLUTION WITH SURFACTANTS Final Report, 16 Jan. - 30 Oct. 1976
Y. Okamoto, E. J. Chou, J. Wang, and Milton Roth (Army Armament R and D Command, Dover, N. J.) Dover, N. J. ARRADCOM Oct. 1977 42 p refs
(Contract DAAA23-76-C-0104)
(AD-E400020; AD-A048332; ARLCD-TR-77038) Avail: NTIS HC A03/MF A01 CSCL 13/2

The 2, 4, 6-Trinitrotoluene (TNT) has contaminated the wastewater emanating from plants engaged in not only the manufacture but also the loading, assembling and packing of TNT. It was found that certain surfactants containing amino groups reacted rapidly with TNT in aqueous solution. The reaction product was a dark brown material which was insoluble in water. When the initial concentration of TNT was in the range of 120-140 ppm, after reacting with surfactant the TNT concentration in the filtrate was found to be at trace levels. Thus, this reaction was developed for the purification of wastewater containing TNT. The reaction mechanisms of the process are discussed. Author

N78-18578# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapon Systems Lab.
CHARCOAL REGENERATION. PART 1: MECHANISM OF TNT ADSORPTION
Thomas C. Castorina, Jerome Haberman, and Jagadish Sharma Nov. 1977 55 p refs
(DA Proj. 1L7-62720-D-048)
(AD-A048757; AD-E400023; ARLCD-TR-77065) Avail: NTIS HC A04/MF A01 CSCL 13/2

The interaction of TNT with the surface of activated carbon (FS300) has been studied via adsorption isotherms of TNT and water, surface area determinations and electron spectroscopy for chemical analysis (ESCA). The rate and extent of adsorption of TNT is strongly dependent on the particle size of FS300 and hence on the diffusion rate, and independent of pH and temperature. The process of deactivation of the carbon surface is shown to involve progressive irreversible occlusion of the microporous structure with each successive adsorption/desorption (with acetone) cycle. The irreversibility of TNT adsorption is attributed to chemical interaction and a mechanism for the deactivation of the carbon surface is postulated. Author (GRA)

N78-18579# Naval Research Lab., Washington, D. C.
THE 1976 NRL AIR QUALITY DATA Final Report
Aristides Stamulis Nov. 1977 45 p refs
(AD-A048750; AD-E000072) Avail: NTIS HC A03/MF A01 CSCL 13/2

Air quality data obtained during the calendar year 1976 at the NRL air monitoring site are reported for ozone (O3), sulfur dioxide (SO2), nitrogen dioxide (NO2), total hydrocarbons (THC), methane (CH4), non-methane hydrocarbons (RHC), carbon monoxide (CO), wind speed, and wind direction. The instruments measuring the above variables are interfaced to a data acquisition system including a magnetic tape recorder. The input on the magnetic tape is in 5-minute increments (averages) for one month's accumulation of data. Subsequently, a computer printout is available for reporting the monthly air quality data. The yearly summary is a composite version of the monthly data.
Author (GRA)

N78-18580# Olson Labs., Inc., Anaheim, Calif.
EFFECT OF PRECONDITIONING ON IN-USE VEHICLE TESTING AND FAILURE ANALYSIS OF EVAPORATIVE EMISSION CONTROL SYSTEMS
Richard R. Carlson Aug. 1977 70 p
(Contract EPA-68-03-2412)
(PB-274902/6; EPA-460/3-77-013) Avail: NTIS HC A04/MF A01 CSCL 13B

Evaporative and exhaust emission tests were performed on 20 late model catalyst equipped vehicles to investigate the effect of three preconditioning procedures consisting of: (1) no preconditioning; (2) 1975 functional test procedure driving schedule; and (3) 10 minute road route. A failure analysis was also performed on several vehicles which were found to either have high evaporative emissions or evaporative emissions which were higher than similarly equipped vehicles. Author

N78-18581# Environmental Protection Agency, Washington, D. C. Div. of Stationary Source Enforcement.
COMPLIANCE STATUS OF MAJOR AIR POLLUTION FACILITIES Final Report
Nov. 1977 717 p
(PB-275005/7; EPA-340/1-77-024) Avail: NTIS HC A99/MF A01 CSCL 13B

The contents of this report were generated from the U.S. Environmental Protection Agency's Compliance Data System and were not intended to represent the true legal status of facilities with respect to applicable air pollution regulations but rather those facilities of interest to the States or the Agency for further investigation. Author

N78-18582# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
GUIDELINES FOR THE REGIONAL EVALUATION OF STATE AND LOCAL NSR (NEW SOURCE REVIEW) PROGRAMS
Daniel J. DeRoeck Nov. 1977 52 p
(PB-275053/7; EPA-450/2-77-027; OAQPS-1.2-084) Avail: NTIS HC A04/MF A01 CSCL 13B

In addition to defining a minimum level of adequate program responsibility the guideline identified problems which were common to a number of agencies. Essential new source review program considerations were described in terms of regulatory requirements and agency operating procedures. Also described was the environmental protection agency, a regional responsibility for auditing State issued permits for completeness and enforceability. Regions were expected to document evaluation findings and to prepare a report containing recommended solutions to those difficulties identified. Negotiations with each agency produced a commitment to undertake steps necessary for program improvement. Author

N78-18583# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands).
THE OCCURRENCE OF PHOTOCHEMICAL SMOG FORMATION IN WESTERN EUROPE
L. J. Brasser, R. Guicherit, and C. Huygen 1976 18 p refs
(IG-Publ-597) Avail: NTIS HC A02/MF A01

An overview of the occurrence of photochemical smog in western Europe is given. Topics dealt with include meteorological factors; influence of ozone, peroxyacetylnitrate (PAN), reactive hydrocarbons, and nitrogen oxides; visibility; and air quality standards. ESA

N78-18584# Industrial Environmental Research Lab., Research Triangle Park, N. C.
PROCEEDINGS OF THE 2ND STATIONARY SOURCE COMBUSTION SYMPOSIUM. VOLUME 4. FUNDAMENTAL COMBUSTION RESEARCH
Joshua S. Bowen and Robert E. Hall Jul. 1977 336 p refs Proc. held at New Orleans, 29 Aug. - 1 Sep. 1977
(PB-274029/8; EPA-600/7-77-073d-Vol-4) Avail: NTIS HC A15/MF A01 CSCL 21D

Discussed are: fundamental combustion research applied to pollution control; chemical reactions in the conversion of fuel nitrogen to NOx-fuel pyrolysis studies; fate of fuel nitrogen during pyrolysis and oxidation; interactions between sulfur oxides and nitrogen oxides in combustion processes; chemical reactions in the conversion of fuel nitrogen to NOx - low pressure flat-flame burner studies; formation of soot and polycyclic aromatic hydrocarbons in combustion systems - development of a molecular beam mass spectrometer; investigation of NOx, nitrate and sulfate production in laboratory flames. Author

N78-18585# Yugoslav Academy of Sciences and Arts, Zagreb. Inst. for Medical Research and Occupational Health.
BIOLOGICAL SIGNIFICANCE OF SOME METALS AS AIR POLLUTANTS. PART 1, LEAD Final Report, Jan. 1969 - Jan. 1974
Mirka Fugas Research Triangle Park. Health Effects Research Lab. Sep. 1977 344 p refs
(Grant SFCP-02-302-3)
(PB-274055/3; EPA-600/1-77-041) Avail: NTIS HC A15/MF A01 CSCL 06T

The relationship between the concentration of a metal in air and in blood of exposed persons, and biological effects which may be attributed to the exposure of a given metal was studied. The study was carried out at four levels of exposure to lead. The four population groups were: occupationally exposed workers, and inhabitants of industrial, urban and rural areas. Author

N78-18586# SRI International Corp., Menlo Park, Calif.
MEASUREMENT OF RATE CONSTANTS OF IMPORTANCE IN SMOG Final Report, Apr. 1973 - Jul. 1977
John R. Barker, Sidney W. Benson, G. David Mendenhall, and David M. Golden Research Triangle Park, N. C. EPA Oct. 1977 145 p refs
(Grant EPA-R-802288)
(PB-274530/5; EPA-600/3-77-110) Avail: NTIS HC A07/MF A01 CSCL 04B

Experimental determinations of certain elementary reaction rate constants; development of general techniques for estimating elementary reaction rate constants; and estimation of many reactions important in smog were investigated. Specific estimated rate constants included the following reactions: (1) Decomposition of alkoxy radicals; (2) Isomerization of alkoxy radicals; (3) Reactions of alkoxy radicals; (4) Reaction HO2 + NO2 yields HO2NO2. Author

N78-18587# Stanford Research Inst., Menlo Park, Calif.
ADVANCED FOSSIL FUEL AND THE ENVIRONMENT: AN EXECUTIVE REPORT
Phyllis Dorset, Dave Myers, Tom Parker, and Richard Laska Washington EPA Jun. 1977 30 p refs
(Contract EPA-68-01-2940)
(PB-274541/2; EPA-600/9-77-013) Avail: NTIS HC A03/MF A01 CSCL 07A

An overview of some of the more advanced fossil fuel technologies is given, including several chemical coal cleaning and liquid fuels cleaning methods. Synthetic fuels, chemically active fluid beds, and oil shale were also considered as viable advanced processes and control technologies. Processes, state-of-the-art, and environmental impacts which are being, or were investigated are discussed. Author

N78-18588# San Jose State Univ., Calif. Dept. of Meteorology.
OZONE OVER SAN FRANCISCO. MEANS AND PATTERNS DURING POLLUTION EPISODES Final Report, Apr. 1973 - Aug. 1977
Kenneth P. MacKay Nov. 1977 123 p refs
(Grant EPA-R-802235)
(PB-274452/2; EPA-600/4-77-046) Avail: NTIS HC A06/MF A01 CSCL 04B

Area-wide air pollution occurred when a lobe of the Pacific high pressure system penetrated inland. During these episodes, superposition of synoptic scale northeasterly flow and locally produced mesoscale flow caused easterly or light westerly flows during the late forenoon within the inversion layer and westerly flow in the late afternoon. Inland, where the inversion was destroyed from below, inversion layer and surface generated pollutants were convectively mixed. This mixing and the wind oscillation recycled pollutants. It reverted to one more normal for the season and pollutants were advected from the area. Author

N78-18589# Air Pollution Technology, Inc., San Diego, Calif.
GAS-ATOMIZED SPRAY SCRUBBER EVALUATION Final Report, Feb. - Aug. 1977
Seymour Calvert Oct. 1977 77 p refs
(Contract EPA-68-02-1869)
(PB-274449/8; EPA-600/2-77-209a) Avail: NTIS HC A05/MF A01 CSCL 07A

Results of fine particle collection efficiency measurements of a gas-atomized spray scrubber are given. Tests were made at several levels of pressure drop and liquid/gas ratio. Particle size measurements on inlet and outlet gas streams were made with cascade impactors and a screen-type diffusion battery. GRA

N78-18590# Industrial Environmental Research Lab., Research Triangle Park, N. C.
PROCEEDINGS OF THE 2D STATIONARY SOURCE COMBUSTION SYMPOSIUM. VOLUME 5: ADDENDUM
Joshua S. Bowen and Robert E. Hall Jul. 1977 216 p refs Symp. held at New Orleans, 29 Aug. - 1 Sep. 1977
(PB-274897/8; EPA-600/7-77-073e) Avail: NTIS HC A10/MF A01 CSCL 21D

Aspects of air pollution control discussed include the effects of fuel and atomization on NOx control for heavy liquid fuel-fired package boilers, NOx control techniques for package boilers, a comparison of burner design, fuel modification and combustion modification. Federal regulations, and existing stationary combustion source air pollution regulations are summarized. Fluidized bed combustion, coal-oil mixture combustion technology and advanced combustion systems for stationary gas turbines are also considered as are emission characteristics of small stationary diesel engines and combustor design concepts of advanced energy conversion systems. GRA

N78-18591# National Inst. for Occupational Safety and Health, Cincinnati, Ohio. Div. of Surveillance, Hazard Evaluation and Field Studies.
REVIEW AND EVALUATION OF ANALYTICAL METHODS FOR ENVIRONMENTAL STUDIES OF FIBROUS PARTICULATE EXPOSURES
Ralph D. Zumwalde and John M. Dement May 1977 73 p refs
(PB-274750/9; DHEW/PUB/NIOSH-77/204) Avail: NTIS HC A04/MF A01 CSCL 06J

Sampling and analytical methods which may be used to identify and quantify fibrous particulates in environmental samples are presented, and the electron microscopic methods used are described in detail. The main topics covered include: optical microscopic methods; differential thermal analysis; X-ray diffraction; microchemical techniques; comparision of transmission and scanning electron microscopy; methods for fiber sampling and analysis, including sample collection and preparation, analytical instrumentation, and identification and characterization procedures. Electron photomicrographs of many fibrous minerals were included. GRA

N78-18592# Council of State Governments, Washington, D.C.
DIFFUSE SOURCE POLLUTION: POLICY CONSIDERATIONS FOR THE STATES State Environmental Issues Series
Mar. 1977 54 p refs
(Grant NSF ISR-75-20393)
(PB-274493/6; RM-606; LC-77-622654) Avail: NTIS HC A04/MF A01 CSCL 13B

The control of nonpoint sources of water pollution and

complex, indirect sources of air pollution are recognized as among the most pressing environmental issues confronting state government. These types of pollution share some common features and are jointly referred to as diffuse source pollution in this report. The technical and institutional complexity of diffuse source management challenges the creativity of state government. The problems and opportunities of implementing successful programs to control diffuse sources are explored in this report. In seeking to maintain or enhance air and water quality, the States have been impeded by legal challenges of EPA-approved plans and continuing litigation relative to EPA regulations designed to implement diffuse sources acts under the Clean Air Act of 1970 and the Federal Water Pollution Control Act of 1972. The need for innovative organizations arrangements and greater coordination at all government levels is mandatory for successful implementation of diffuse source controls. The report discusses regulating diffuse source pollution and implementing diffuse source pollution programs. GRA

N78-18593# GCA Corp., Bedford, Mass. Technology Div.
IMPROVEMENTS TO SINGLE-SOURCE MODEL VOLUME 3. FURTHER ANALYSIS OF MODELING RESULTS Final Report
Michael T. Mills Aug. 1977 159 p refs
(Contract EPA-68-02-1376)
(PB-274527/1; GCA-TR-76-6-G(3); EPA-450/3-77-003c) Avail: NTIS HC A08/MF A01 CSCL 13B

An evaluation of model performance stratified by six stability classes, three wind speed classes, and three mixing height classes is documented. The model accuracy was found to be dependent on stability class. For stabilities A and B, the model showed some tendency to overestimate concentrations, especially near the plant. For stabilities D, E, and F, the model greatly underestimated concentrations at all but the most distant sampler. For stability C, the model tended to agree with the measurements. High wind speeds resulted in a trend toward underestimates at the Muskingum plant, and a trend toward underestimates at the Canal plant. GRA

N78-18594# Environmental Protection Agency, Ann Arbor, Mich. Standards Development and Support Branch.
SHIFT SCHEDULES FOR EMISSIONS AND FUEL ECONOMY TESTING Report on Technical Support for Regulatory Agencies
Richard A. Rykowski Nov. 1977 33 p refs
(PB-274865/5; LDTP-77-6) Avail: NTIS HC A03/MF A01 CSCL 13B

The current method for determining the shift schedules used during certification was examined and it was determined whether or not this method is resulting in shift schedules which are representative of those used by typical drivers. The history of the method of determining shift schedules for the certification process was first examined, than the current trends of shift schedules found in vehicle owner's manuals were determined, since these are the sources of the shift schedules used during certification. The methods of determining shift schedules of other automobile testing organizations were studied, as well as how people are taught to shift in driver's education schools. GRA

N78-18595# Environmental Protection Agency, Ann Arbor, Mich. Standards Development and Support Branch.
AIRCRAFT EMISSION FACTORS
Robert G. Pace Mar. 1977 29 p refs
(PB-275067/7; AC-77-03) Avail: NTIS HC A03/MF A01 CSCL 13B

Updated aircraft engine emission factors and a sample of the calculation methodology used in obtaining these numbers are presented. Modal emission factors were calculated for a number of gas turbine and piston aircraft engines. Emission factors per aircraft per landing take-off cycle were calculated for representative aircraft engine combinations. Included were commercial jet transports, business jets, turboprops and general aviation piston aircraft. GRA

N78-18596# Industrial Environmental Research Lab., Research Triangle Park, N. C.
EPA FABRIC FILTRATION STUDIES. 5: BAG CLEANING TECHNOLOGY, HIGH TEMPERATURE TESTS Final Task Report, Jun. 1974 - Jan. 1977
B. E. Daniel, R. P. Donovan, and J. H. Turner Nov. 1977 44 p refs
(PB-274922/4; EPA-600/7-77-095b) Avail: NTIS HC A03/MF A01 CSCL 13K

Results of a laboratory study to determine the influence of high temperature operation on the selection of fabric filter shake-cleaning parameters are given. Two cotton and two Dacron bags were operated in a laboratory baghouse, using heated air passed through cement dust as the source of dirty air. The bags cleaned at high 'g' forces showed more deterioration in strength properties than those cleaned at 1.9 g's. GRA

N78-18597# Olson Labs., Inc., Anaheim, Calif.
VEHICLE EXHAUST EMISSION INSTRUMENTS EVALUATION Final Report
Steve N. Schlingmann Jul. 1977 288 p refs
(Contract EPA-68-03-2353)
(PB-274547/9; EPA-460/3-77-014) Avail: NTIS HC A13/MF A01 CSCL 14B

The market of exhaust emission analyzers was surveyed. All exhaust emission manufacturers, whose product could be used in vehicle inspection/maintenance programs, were identified, and a representative group of instruments was selected and tested to evaluate their performance. It was found that the vast majority of instruments use an infrared absorption operating principle and that their hydrocarbon response characteristics generally showed greater sensitivity to isobutylene, followed by toluene, methane, and ethylene. GRA

N78-18598# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
CONTROL STRATEGY PREPARATION MANUAL FOR PARTICULATE MATTER Final Report
Sep. 1977 126 p refs
(PB-274861/4; EPA-450/2-77-023; PAQPS-1-2-049) Avail: NTIS HC A07/MF A01 CSCL 13B

A general discussion of the technical aspects of particulate matter control strategy development is presented. Emphasis is placed on a brief review of pertinent facts supplemented by references to generally available technical documents. Subjects addressed include the attainment of NAAQS; procedures for review and development of a particulate matter control strategy; and question and answer sections discussing particulate emission sources and types, measurement methods, data and funds utilization, modeling, control technology, and control strategy issues. GRA

N78-18599# Environmental Quality Research, Inc., Clayton, Mo.
NEAR-SURFACE AIR PARCEL TRAJECTORIES: ST. LOUIS, 1975 Final Report
L. J. Hull, W. P. Dannevik, and S. Frisella Nov. 1977 210 p refs Sponsored by EPA
(PB-274368/0; EPA-600/3-77-123) Avail: NTIS HC A10/MF A01 CSCL 13B

A technique was described that uses the St. Louis Regional Air Monitoring System (RAMS) to provide wind measurements for the local urban scale. A computerized trajectory model was described that computes near surface air parcel motions. Results were presented for a study of 50 trajectory case studies during the summer of 1975 St. Louis experiments. It was concluded that the use of RAMS minute averaged data was made a fully operational segment of the trajectory model and produces a detailed and accurate description of the urban wind field. The model can be modified to accept wind observations on any time or distance scale. Author

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N78-18600 Indiana Univ., Bloomington.
ELLIPTICITY OF 0.4 TO 2.4 HERTZ RAYLEIGH WAVES WITH APPLICATION TO THE STUDY OF NEAR SURFACE EARTH STRUCTURE Ph.D. Thesis
Ralph William Knapp 1977 193 p
Avail: Univ. Microfilms Order No. 77-22662

Very high frequency Rayleigh waves were studied to determine whether ellipticity, defined as the ratio of the horizontal and vertical component spectra of surface displacement, behaved as theoretically predicted for Rayleigh waves propagating on a horizontally layered half space. Observation of the phase difference of the vertical and radial spectral components served as a means of recognizing Rayleigh wave energy. Observations from 200 digitally recorded seismic events, most being surface coal mine explosions ar distances of 40 to 150 kilometers and directions between 185 deg and 323 deg azimuth from the receiver, show that the phase difference is statistically scattered about the theoretically predicted value of pi/2 and that ellipticity is distributed about single values. Dissert. Abstr.

N78-18601 Michigan Univ., Ann Arbor.
THE GEOLOGY OF THE GREAT LAKES ICE COVER Ph.D. Thesis
Ernest Willard Marshall 1977 643 p
Avail: Univ. Microfilms Order No. 77-26298

Geological processes and features of the Great Lakes coastal zone during winter and spring were examined in detail and extensively illustrated by ground and aerial photographs. There were 39 geological, ice-forming regions identified on the Great Lakes and in the connecting lakes, straits and rivers. The patterns of ice land formation on the Great Lakes in mild, normal, and severe winters are illustrated by ice charts. The areas of icelands formed on the Great Lakes and in the shorelands are presented by lake, by state or province. Finally, the significance of Great Lakes icelands to resource management is discussed by viewing their impact on the following five areas of public concern: public health, winter recreation, shorelines, winter shipping, and jurisdiction. Included within the appendices were sections on methods and techniques for lake ice investigations as well as a short history of the Great Lakes ice cover resource.
Dissert. Abstr.

N78-18602 California Univ., Riverside.
HEAT FLOW IN A GEOTHERMALLY ACTIVE AREA: THE GEYSERS, CALIFORNIA Ph.D. Thesis
Iain Macdonald Jamieson 1976 176 p
Avail: Univ. Microfilms Order No. 77-27151

The Geysers steam field in northern California is well established with almost 200 geothermal wells in an area of approximately 16 square miles and an installed generating capacity of 522 megawatts. A study of temperature gradients, topographic effects, reservoir characteristics and their correlation was made in a portion of this area using data from shallow temperature dragient holes and from several suspended of abandoned wells. Analysis od the temperature gradients corrected for topographic effect indicates that gradients are extremely high over the known reservoir and that heat transfer from the reservoir to the surface is primarily by conduction. In close proximity to production, gradients corrected for topographic effect are much lower. This suggests a reservoir controlled by high angle fractures, a hypothesis which is in accord with data from drilling records in the area. Dissert. Abstr.

N78-18603 Stanford Univ., Calif.
TIME DEPENDENT FAULT MECHANICS AND WAVE PROPAGATION IN ROCKS Ph.D. Thesis
Gerald Mathew Mavko 1977 181 p
Avail: Univ. Microfilms Order No. 77-25701

A number of simple mechanical models are presented for the transient or inelastic elements of a major earthquake cycle. The gross response of faulting is studied by approximating the earth's crust and upper mantle as a stiff elastic lithosphere over a weaker ductile asthenosphere. Several localized mechanisms for attenuation and material relaxation are then discussed.
Dissert. Abstr.

N78-18604 Cincinnati Univ., Ohio.
A TWO DIMENSIONAL MHD MODEL FOR MAGNETIC FIELD LINE RECONNECTION IN AN INCOMPRESSIBLE AND INVISCID PLASMA Ph.D. Thesis
Shadia Rifai Habbal 1977 77 p
Avail: Univ. Microfilms Order No. 77-29711

A two-dimensional field line reconnection mechanism is proposed which can be generalized into a time-dependent model. The special case of a stationary hyperbolic magnetic field configuration is studied in detail. The corresponding flow pattern for an inviscid and incompressible plasma is found from solving Ohm's law and the continuity equation in two regions of space, the convection region where the conductivity is practically infinite and where the field lines are still frozen to the plasma, and the diffusion region surrounding the neutral point where the conductivity is finite allowing reconnection to take place. The magnetic field line reconnection mechanism proposed leads to one physically acceptable solution that satisfies the coupled MHD equations. No a priori assumptions were made for the existence of shocks or discontinuities in the flow. The discontinuities arise naturally from the solution and coincide with the separatrix in the convection region. Dissert. Abstr.

N78-18605 Utah Univ., Salt Lake City.
FINITE ELEMENT SOLUTION TO EQUATIONS FOR TURBULENT MOTION AND DIFFUSION IN PLANETARY BOUNDARY LAYER Ph.D. Thesis
Hsi-nan Lee 1977 101 p
Avail: Univ. Microfilms Order No. 77-29584

The research resulted in the first successful experiment using the finite element technique to solve the model proposed here for computing turbulent field and diffusion based on a second-order closure scheme in the atmospheric planetary boundary layer. The numerical technique and model developed could be extended to a non-neutral case. Since there is no shape assumption of eddy diffusivity for contentration, the model is expected to be valid for studying air pollution over a wide range of flat surfaces or horizontally complicated inhomogeneous terrain. Also the finite element technique is expected to be a powerful tool for solving the problem because it fits easily the boundary and changes parameters easily over the entire domain. The model proposed consisted of two types of field; one for a vector field including velocity and turbulent quantities, and the other for a scalar field which is pollutant concentration. Dissert. Abstr.

N78-18606 California Univ., Berkeley.
VELOCITIES OF COMPRESSIONAL WAVE IN ROCKS OF CENTRAL CALIFORNIA AT HIGH PRESSURE AND HIGH TEMPERATURE AND APPLICATIONS TO THE STUDY OF THE CRUSTAL STRUCTURE OF CALIFORNIA COAST RANGES Ph.D. Thesis
Wu-Nan Lin 1977 190 p
Avail: Univ. Microfilms Order No. 77-31443

Laboratory measurements of the P-wave velocities of the major types of crustal rocks in central California were made under hydrostatic pressures up to 7 kbars and temperatures up to 450 C. Reversible and consistent velocity data were obtained for these rock specimens. At pressures greater than 4 kbars, velocities were linear functions of pressure and temperature. The velocity derivatives with respect to pressure and temperature were calculated from the laboratory data obtained at pressures greater than 4 kbars. Dissert. Abstr.

N78-18607# Air Force Geophysics Lab., Hanscom AFB, Mass.
ADAPTIVE MAPPING OF MID-LATITUDE IONOSPHERE
Richard S. Allen, Gerhard K. Hartmann, Delia E. Donatelli, and Reinhart Leitinger 3 Aug. 1977 20 p refs
(AD-A048116; AFGL-TR-77-0176; AFGL-AFSG-372) Avail: NTIS HC A02/MF A01 CSCL 04/1

Maps of the monthly median of refractive effects are used by precision navigation and radar systems to correct for measurement errors caused by the ionosphere. Calculated off line using available climatologies of the pertinent ionospheric parameters, they are used in real time systems to remove 70 to 75 percent of the monthly rms error. When greater precision is required, these maps may be adapted by any of several local measurements of current ionospheric conditions. The residual refractive error is dependent on the density of these local

measurements in space and time and on their ability to characterize the current ionosphere. Systematic variations of the ionosphere are usefully predicted over a few hours. Local features that have large geophysical scale size, such as the nighttime trough and the plasmapause enhancement of the mid-latitude ionosphere, are tracked by sequential measurements and may be mapped in space and local time across the entire system field of view during quiet geophysical periods. During disturbed periods, however, their dynamic behavior may require more frequent specifications and, in addition, very large features can develop which are sharply confined to small areas of the coverage region. GRA

N78-18608# Air Force Geophysics Lab., Hanscom AFB, Mass.
CORRELATION DISTANCE OF MEAN DAYTIME ELECTRON CONTENT
John A. Klobuchar and J. M. Johanson 22 Aug. 1977 25 p refs
(AD-A048117; AFGL-TR-77-0185; AFGL-AFSG-373) Avail: NTIS HC A02/MF A01 CSCL 04/1

In the total electron content (TEC) monitoring station network, an important parameter is the required number of stations for a given percentage improvement over the use of monthly median predicted values. Using data from nine TEC stations, taken a pair at a time, values are computed for the correlation coefficient for the 10 to 16 hour local time period when the diurnal values of TEC are generally highest. Little consistent seasonal differences were found in the correlation coefficient values. Thus simple linear relations between station separation and correlation coefficient were chosen for stations having approximate north-south and east-west spacings. For a 50 percent improvement in TEC prediction over a monthly median value, TEC monitoring stations must be spaced approximately 2400 km in longitude and 1600 km in latitude. These values agree reasonably well with previous studies of the correlation distance of the ionospheric parameter foF2. GRA

N78-18609# Stanford Univ., Calif. Guidance and Control Lab.
STUDY TO DEVELOP GRADIOMETER TECHNIQUES Final Report, Jul. 1975 - Jun. 1976
Daniel B. DeBra and Eugene J. Pelka Jun. 1977 336 p refs
(Contract F19628-74-C-0162; AF Proj. 8607)
(AD-A048252; AFGL-TR-76-0297) Avail: NTIS HC A15/MF A01 CSCL 08/5

The primary goal of the gravity gradiometer research effort at Stanford University has been to establish the feasibility of operation of a gravity gradiometer in a closed loop mode. A parameter estimation technique will allow for on-line modification (compensation) of the sensor output signal, as well as for trimming of pertinent sensor physical properties so as to improve instrument performance. Gravity gradiometers are required to operate with an accuracy of 1 EU (Eotvos unit). This is so demanding that closed loop mode operation may be essential. Although attention has been focussed exclusively upon the Hughes rotating gravity gradiometer (RGG), the parameter estimation method developed is applicable, in principle, to any instrument subject to dynamically induced errors. Author (GRA)

N78-18610# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Soils and Pavements Lab.
EARTHQUAKE RESISTANCE OF EARTH AND ROCK-FILL DAMS. REPORT 5: PERMANENT DISPLACEMENTS OF EARTH EMBANKMENTS BY NEWARK SLIDING BLOCK ANALYSIS
Arley G. Franklin and Frank K. Chang Nov. 1977 65 p refs
(AD-A048346; AEWES-MP-71-17-5; Rept-5) Avail: NTIS HC A04/MF A01 CSCL 08/11

In 1965, Newmark described methods for computing permanent displacements of embankments subjected to earthquake loading, and provided a chart for estimating the upper bounds of permanent displacements on the basis of a sliding block model and four earthquake records. Since that time, many additional strong-motion records have been obtained in the western United States, and it was decided to extend the data base for Newmark's chart by making use of these records. For this purpose, a computer program was written to integrate the digitized accelerograms and compute the permanent displacements from the velocity-time history and the resistance coefficients. All records were scaled to 0.5g peak acceleration and 30-in/sec peak velocity, and the resulting scaled permanent displacements are called standardized maximum displacements. A total of 169 horizontal and 10 vertical corrected accelerograms were processed in addition to several synthetic records. GRA

N78-18611# Stanford Research Inst., Menlo Park, Calif. Molecular Physics Center.
PHOTON INTERACTIONS WITH ATMOSPHERIC NEGATIVE IONS Final Report, 1 Apr. 1976 - 30 Sep. 1977
J. T. Moseley, P. C. Cosby, and J. R. Peterson 30 Nov. 1977 95 p refs
(Contract DAAG29-76-C-0023)
(AD-A048315; SRI-MP-77-114; ARO-13916.2-P) Avail: NTIS HC A05/MF A01 CSCL 04/1

Photodestruction cross sections have been measured for seventeen negative ions of atmospheric importance over the wavelength range from 5000 to 8400 A using a drift tube mass spectrometer coupled with a tunable dye laser. The cross sections vary from zero to nearly 10 to the -17th power sq cm, and thresholds are found for all ions except O2(-) which are photoactive. Vibrational, electronic and isomeric excited states are observed. Author (GRA)

N78-18612# Naval Research Lab., Washington, D. C.
MORPHOLOGICAL STUDIES OF RISING EQUATORIAL SPREAD F BUBBLES Interim Report
Sidney L. Ossakow and P. K. Chaturuedi Nov. 1977 63 p refs
(AD-A048752; AD-E000080; NRL-MR-3650) Avail: NTIS HC A04/MF A01 CSCL 20/9

Analytical electrodynamic morphological studies of rising equatorial Spread F bubbles, within the context of the collisional Rayleigh-Taylor regime, are presented. The analogy between bubbles (plasma density depletions) and barium clouds (plasma density enhancements) is noted. Bubbles tend to steepen on their top and elongate in the vertical direction and they narrow horizontally as they rise through the equatorial F region ionosphere. Linear and nonlinear models of constant shape bubbles are presented. It is shown, for these models that the vertical bubble rise velocity, V sub B = (g/upsilon sub in) f(delta n/n sub o), where upsilon sub in is the ion-neutral collision frequency and f is an increasing function of delta n/n sub o (fractional density depletion), depending on the shape of the bubble. Consequently, high altitudes and/or large percentage plasma depletions yield large vertical bubble rise velocities. The models are extended to include arbitrary electric fields in addition to the gravitational force. Author (GRA)

N78-18613# Regis Coll., Weston, Mass.
A GENERALIZED COMPUTER PROGRAM FOR PRIMITIVE-EQUATION MODELS Progress Report, 1 Oct. 1976 - 30 May 1977
Thomas J. Leonard and Jack C. Mettauer 30 May 1977 147 p refs
(Contract F19628-77-C-0010; AF Proj. 2310)
(AD-A048481; Scientific-1) Avail: NTIS HC A07/MF A01 CSCL 04/2

This program is an attempt at a large scale, multi-level general circulation model of the atmosphere. The original conception was to implement a very flexible program. The major programs are: INITE (Since a typical problem will require more storage than can be accomodated, this program parcels the data and codes information as to how it is partitioned.); GEX (A solution program to step the fields ahead in time.); and DISPLAY (This program displays the various fields which have been saved from the GEX run.) Author (GRA)

N78-18614# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
GEOMAGNETIC DATA FOR MARCH 1976 (AE (7) INDICES AND STACKED MAGNETOGRAMS)
J. H. Allen, C. C. Astron, and L. D. Morris Sep. 1977 65 p
(PB-275096/6; UAG-63) Avail: NTIS HC A04/MF A01 CSCL 04A

Selected geomagnetic variation data for March 1976 are presented. Included are analog records from seven auroral zone

stations; preliminary AE indices based on these data; and various related tables, graphs, and statistics. GRA

N78-18615# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
GEOMAGNETIC DATA FOR FEBRUARY 1976 (AE (7) INDICES AND STACKED MAGNETOGRAMS
J. H. Allen, C. C. Abston, and L. D. Morris Sep. 1977 62 p
(PB-275095/8; UAG-62; IMS-Data Pub-2; NOAA-77101721)
Avail: NTIS HC A04/MF A01 CSCL 04A

Analog records from seven auroral zone stations, preliminary AE INDICES based on these data and various related tables, graphs and statistics are presented. GRA

N78-18616# Centre National de Recherches de l'Espace, Brussels (Belgium).
REPORT PRESENTED TO THE 20TH COSPAR GENERAL ASSEMBLY [RAPPORT BELGE A LA 20EME ASSEMBLEE PLENIERE DU COSPAR A TEL AVIV]
1977 19 p refs In FRENCH Conf. held at Tel Aviv, Israel, 7-18 Jun. 1977
Avail: NTIS HC A02/MF A01

Belgian space activities in 1976 are presented. Separate sections deal with minority atmospheric constituents, UV solar flux and absorption, thermosphere, plasmakinetics in auroral and polar cusp, magnetosphere and solar wind structure, adiabatic invariant generalization, hot stellar atmospheres, spectrophotometric catalog of UV stars, auroral airglow spectroscopy, and IR solar observations by stratospheric balloons. ESA

N78-18617# National Geodetic Survey, Rockville, Md. Research and Development Lab.
SYSTEMS FOR THE DETERMINATION OF POLAR MOTION
Soren W. Henriksen May 1977 65 p refs
(PB-274698/0; NOAA-TR-NOS-72-NGS-7; NOAA-77101212)
Avail: NTIS HC A04/MF A01 CSCL 08E

Data produced by classical methods since 1899, are insufficient to permit accurate prediction of polar motion, to determine the amount or existence of secular drift of the pole, or to detect the possible effects of earthquakes on polar motion. The international participants in a program designed for the maintenance of an internationally accepted coordinate reference system agree that the program should be continued for at least another 50 to 100 years and that more accurate observation methods should be developed. A number of alternatives for solution of the problems enumerated and for consideration by the international community are presented by the National Geodetic Survey. GRA

N78-18618# SRI International Corp., Menlo Park, Calif.
THE RELATION OF OXIDANT LEVELS TO PRECURSOR EMISSIONS AND METEOROLOGICAL FEATURES. VOLUME 1: ANALYSIS AND FINDINGS Final Report
F. L. Ludwig, E. Reiter (Colorado State Univ.), E. Shelar, and W. B. Johnson Oct. 1977 165 p refs
(Contract EPA-68-02-2084)
(PB-275001/6; EPA-450/3-77-022-a-Vol-1) Avail: NTIS HC A08/MF A01 CSCL 04A

Tropospheric causes of high ozone concentrations away from cities have been investigated by statistical analysis of meteorological conditions and the precursor emissions occurring along air trajectories and by comparisons of weather maps and large-scale O3 distributions. At sites well removed from cities, the upwind emissions of oxides of nitrogen are more strongly related to ozone concentrations than are the emissions of hydrocarbons. Widespread violations of the Federal oxidant standard are most likely to be found in association with a stagnant high-pressure system or in the warm southwesterly flow in the western portion of a high pressure area, often ahead of an approaching cold front. The results of this and other studies suggest that not all violations of the Federal oxidant standard are controllable and this fact must be considered in the design of control strategies. Also, for areas within about 125 km of large cities, control might be achieved through the reduction of HC emissions. In more remote areas, control strategies involving NOx control throughout large regions must be considered. GRA

N78-18619# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Lab.
ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. NORTHEAST GULF OF ALASKA Annual Reports Summary, year ending Mar. 1975
May 1977 300 p refs Sponsored in part by Bureau of Land Management
(PB-275212/9; NOAA-77110405) Avail: NTIS HC A13/MF A01 CSCL 13B

The establishment of an environmental baseline in the region, against which development-related impacts might be detected and assessed; and to provide a basis for evaluating the primary impact of the petroleum development on the marine environment of the region were primary objectives. The results of first year studies are given, and outlined. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N78-18620 Wisconsin Univ., Madison.
A PHYSICALLY BASED CLIMATE MODEL OF HEMISPHERIC MEAN SURFACE TEMPERATURE WITH PREDICTIVE CAPABILITY Ph.D. Thesis
Gerald John Dittberner 1977 181 p
Avail: Univ. Microfilms Order No. 77-19707

A simple climate model may be constructed on a physical basis on the form of a differential equation with three input variables: volcanic aerosols, anthropogenic aerosols and atmospheric carbon dioxide concentration. The stratospheric aerosol index needed for the model may be derived from a chronological volcanic eruption inventory. Man's pollution input may be determined from measures of human activity, such as population, and from the recorded use of fossil fuels (coal and oil). The model simulates the behavior of Northern Hemisphere mean temperatures and gives a different pattern of behavior for the Southern Hemisphere. Projections of man's particulate input and the concomitant input of carbon dioxide were calculated from existing predictions of fossil fuel use and population.
Dissert. Abstr.

N78-18621 Royal Observatory, (Hong Kong).
FORECASTING DAILY RAINFALL AMOUNT FOR A SINGLE STATION USING SATELLITE PHOTOGRAPHS
M. Y. Chan Mar. 1976 19 p refs
(TN-21) Copyright. Avail: Issuing Activity

A previously developed mathematical method for estimating the actual average daily rainfall was used to forecast the daily rainfall amount for a single station, like Hong Kong. The method is based on the assumption that measurable rainfall amounts are due to only three types of clouds: cumulonimbus, nimbostratus, and cumulus congestus. The percentage of area covered by each of the rain-producing cloud types in the area are estimated and the total average daily rainfall amount for the area is calculated from an empirical formula as follows, R=(K sub 1 c sub 1 + K sub 2 C sub 2 + K sub 3 C sub 3)/100 where, K sub 1, K sub 2, K sub 3 are predetermined constants which are respectively equal to 1.0, 0.25 and 0.02; C sub 1, C sub 2, C sub 3 are the respective percentages of the area covered by cumulonimbus, nimbostratus and cumulus congestus. Author

N78-18622 Texas A&M Univ., College Station.
REAL-TIME COMPUTER TECHNIQUES IN THE DETECTION AND ANALYSIS OF SEVERE STORMS FROM DIGITAL RADAR DATA Ph.D. Thesis
Thomas Edmund Sieland 1977 154 p
Avail: Univ. Microfilms Order No. 77-32205

A computer method was developed by which multitilt digital radar data can be interpolated in three dimensions and reduced to a two dimensional display of partially vertically-summed reflectivity maps (PVSZ) in near real time. Various combinations of interpolation schemes were used to develop the computer method, and the resultant products were compared to determine whether or not significant features of a severe storm evident in

constant reflectivity maps are retained by the reduction technique. In addition, the number of PVSZ layers was varied to determine the minimum needed for adequate depiction of the tilt of the storm core. Dissert. Abstr.

N78-18623*# M&S Computing, Inc., Huntsville, Ala.
WISP INFORMATION DISPLAY SYSTEM USER'S MANUAL Final Report
P. L. Alley and G. R. Smith 30 Jan. 1978 68 p
(Contract NAS8-32024)
(NASA-CR-150541; Rept-77-042) Avail: NTIS
HC A04/MF A01 CSCL 04B

The wind shears program (WISP) supports the collection of data on magnetic tape for permanent storage or analysis. The document structure provides: (1) the hardware and software configuration required to execute the WISP system and start up procedure from a power down condition; (2) data collection task, calculations performed on the incoming data, and a description of the magnetic tape format; (3) the data display task and examples of displays obtained from execution of the real time simulation program; and (4) the raw data dump task and examples of operator actions required to obtained the desired format. The procedures outlines herein will allow continuous data collection at the expense of real time visual displays. J.C.S.

N78-18624*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR THE DIGITAL DERIVATION OF DAILY AND MONTHLY DATA BASES FROM SYNOPTIC OBSERVATIONS OF TEMPERATURE AND PRECIPITATION FOR THE PEOPLE'S REPUBLIC OF CHINA
B. H. Jeun and G. L. Barger Dec. 1977 117 p
(Contract NAS9-15200)
(NASA-CR-151616; LEC-11680) Avail: NTIS
HC A06/MF A01 CSCL 04B

A data base of synoptic meteorological information was compiled for the People's Republic of China, as an integral part of the Large Area Crop Inventory Experiment. A system description is provided, including hardware and software specifications, computation algorithms and an evaluation of output validity. Operations are also outlined, with emphasis placed on least squares interpolation. B.L.P.

N78-18625*# Teledyne Brown Engineering, Huntsville, Ala.
NATIONAL SEVERE STORMS FORECAST CENTER
Dec. 1977 34 p refs
(Contract NAS8-32539)
(NASA-CR-150547; SD77-MSFC-2177) Avail: NTIS
HC A03/MF A01 CSCL 04B

The principal mission of the National Severe Storms Forecast Center (NSSFC) is to maintain a continuous watch of weather developments that are capable of producing severe local storms, including tornadoes, and to prepare and issue messages designated as either Weather Outlooks or Tornado or Severe Thunderstorm Watches for dissemination to the public and aviation services. In addition to its assigned responsibility at the national level, the NSSFC is involved in a number of programs at the regional and local levels. Subsequent subsections and paragraphs describe the NSSFC, its users, inputs, outputs, interfaces, capabilities, workload, problem areas, and future plans in more detail. Author

N78-18626*# Teledyne Brown Engineering, Huntsville, Ala.
SURVEY: NATIONAL METEOROLOGICAL CENTER
Nov. 1977 31 p ref
(Contract NAS8-32539)
(NASA-CR-150549; SD77-MSFC-2151) Avail: NTIS
HC A03/MF A01 CSCL 04B

The National Meteorological Center (NMC) is comprised of three operational divisions (Development, Automation, and Forecast) and an Administrative Division. The Development Division develops and implements mathematical models for forecasting the weather. The Automation Division provides the software and processing services to accomodate the models used in daily forecasts. The Forecasting Division applies a combination of numerical and manual techniques to produce analyses and prognoses up to 120 hr into the future. This guidance material is combined with severe storm information from the National Hurricane Center and the National Severe Storms Forecasting Center to develop locally tailored forecasts by the Weather Service Forecast Offices and, in turn, by the local Weather Service Offices. A very general flow of this information is shown. A more detailed illustration of data flow into, within, and from the NMC is given. The interrelations are depicted between the various meteorological organizations and activities. Author

N78-18627*# Teledyne Brown Engineering, Huntsville, Ala.
NOAA/NATIONAL HURRICANE AND EXPERIMENTAL METEOROLOGICAL LABORATORY
Dec. 1977 23 p
(Contract NAS8-32539)
(NASA-CR-150550; SD77-MSFC-2178) Avail: NTIS
HC A02/MF A01 CSCL 04B

National Hurricane and Experimental Meteorological Laboratory (NHEML) research programs concentrate on two atmospheric phenomena of the tropical troposphere: hurricanes and cumulus convection, together with the atmospheric environments in which they occur and with which they interact. These programs include basic research in the description of these phenomena and applied research in their prediction and potential beneficial modification. NHEML is partitioned into four working groups. Two important and logical parts of the research programs are the experimental program in hurricane modification (STORMFURY) and the program in cumulus modification (FACE). The ultimate goal of STORMFURY is the reduction of the maximum winds associated with the eyewall of hurricanes; the goal of FACE is to acquire a thorough understanding of cumulus cloud behavior that will enable NHEML to increase precipitation from cumulus clouds. The operational structure of NHEML and related agencies are presented. Author

N78-18628*# Teledyne Brown Engineering, Huntsville, Ala.
SESAME/ENVIRONMENTAL RESEARCH LABORATORIES
Dec. 1977 25 p
(Contract NAS8-32539)
(NASA-CR-150551; SD77-MSFC-2179) Avail: NTIS
HC A02/MF A01 CSCL 04B

The Environmental Research Laboratories (ERL) have been designated as the basic research group of the National Oceanic and Atmospheric Administration (NOAA). ERL performs an integrated program of research and research services directed toward understanding the geophysical environment, protecting the environment, and improving the forecasting ability of NOAA. Twenty-four laboratories located throughout the United States comprise ERL. The Project SESAME (Severe Environmental Storms and Mesoscale Experiment) Planning Office is a project office within ERL. SESAME is conceived as a joint effort involving NOAA, NASA, NSF, and the atmospheric science community to lay the foundation for improved prediction of severe convective storms. The scientific plan for SESAME includes a phased buildup of analysis, modeling, instrumentation development and procurement, and limited-scale observational activities. Author

N78-18629# Federal Aviation Administration, Washington, D. C.
ENGINEERING AND DEVELOPMENT PROGRAM PLAN: WIND SHEAR
Aug. 1977 80 p
(AD-A048352; FAA-ED-15-2A) Avail: NTIS
HC A05/MF A01 CSCL 04/2

A development plan for solutions to the aviation hazards created by low-level wind shear in the terminal area is reported. Included in the plan are: (1) efforts to better characterize low-level wind shear, (2) plans to define the hazards of wind shear for the aviation community, (3) tasks required to develop ground-based devices for hazardous wind shear detection and movement, (4) investigations into the use of airborne equipment to detect hazardous wind shear and then either warn the pilot of its presence and/or assist him in coping with it, (5) a description of how the data collected on wind shear will be processed, analyzed and reported, (6) plans to improve low-level wind shear predictions are presented, and (7) provisions for integrating wind shear data into the NAS by developing data formats and displays suitable to users (air traffic controllers, pilots and the National Weather Service). Program management responsibilities are addressed. A

program schedule with milestones is presented and program funding requirements are identified. Author

N78-18630*# National Meteorological Center, Washington, D. C.
STRATOSPHERIC WARMINGS: SYNOPTIC, DYNAMIC AND GENERAL-CIRCULATION ASPECTS
Raymond M. McInturff, ed. Jan. 1978 173 p refs Sponsored by NASA
(NASA-TP-1017) Avail: NTIS HC A08/MF A01 CSCL 04B

Synoptic descriptions consist largely of case studies, which involve a distinction between major and minor warmings. Results of energetics studies show the importance of tropospheric-stratospheric interaction, and the significance of the pressure-work term near the tropopause. Theoretical studies have suggested the role of wave-zonal flow interaction as well as nonlinear interaction between eddies, chemical and photochemical reactions, boundary forcing, and other factors. Numerical models have been based on such considerations, and these are discussed under various categories. Some indication is given as to why some of the models have been more successful than others in simulating warmings. The question of ozone and its role in warmings is briefly discussed. Finally, a broad view is taken of stratospheric warmings in relation to man's activities. Author

N78-18631*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE NIMBUS 6 DATA CATALOG. VOLUME 9: DATA ORBITS 6803 THROUGH 7619, 1 NOVEMBER - 31 DECEMBER 1976
Nov. 1977 344 p Prepared in cooperation with Management and Tech. Serv. Co., Beltsville, Md.
(Contract NAS5-23740)
Avail: NTIS HC A15/MF A01 CSCL 04B

Operations of various experiments during the reporting period are summarized. Orbital elements, data availability times, anomalies in the data, geographic location, and time of data are tabulated. Montages obtained by infrared and microwave radiometers are included. Author

N78-18632# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
COMPARISON OF DEVELOPING VERSUS NON-DEVELOPING TROPICAL DISTURBANCE M.S. Thesis - Colo. State Univ.
Steven L. Erickson Jun. 1977 95 p refs
(AD-A047780; AFIT-CI-78-12) Avail: NTIS HC A05/MF A01 CSCL 04/2

Developing and non-developing western North Pacific tropical disturbances are investigated and compared utilizing Defense Meteorological Satellite Program (DMSP) and rawinsonde data. Quantitative measurements of deep convection and cirrus amounts from the satellite visual and infrared data indicate that no large deep-convective difference exists between these two classes of disturbances. Genesis appears to be related to the special positioning of the deep convection and surrounding wind fields. When genesis occurs, the deep convection appears to act indirectly to warm the tropical disturbance by means of dynamically forced subsidence. Documentation is provided to support this hypothesis. Relative vorticity, vertical shear, and characteristics of the cirrus level outflow patterns were determined to be parameters which displayed the largest difference between the two classes of developing and non-developing disturbances. It is hypothesized that the potential for tropical disturbance genesis is primarily related to: the large-scale surrounding relative vorticity at lower and upper tropospheric levels, the strength of the disturbance's dynamically forced subsidence, and magnitude of disturbance ventilation or wind blow-through. GRA

N78-18633# Aeronautical Research Associates of Princeton, Inc., N. J.
LOW-LEVEL ATMOSPHERIC TURBULENCE MODEL FOR MARINE ENVIRONMENTS Final Status Report, 15 Nov. 1976 - 15 Nov. 1977
W. S. Lewellen, D. A. Oliver, M. E. Teske, and H. Cote O. Segur Nov. 1977 159 p refs
(Contract N00019-77-C-0131)
(AD-A047980; ARAP-320) Avail: NTIS HC A08/MF A01 CSCL 04/1

This report details the last year's developments to A. R. A. P.'s program for computing the detailed low-level atmospheric distributions of velocity, temperature, moisture, refractive index, and the turbulent variances of these quantities for marine environments. Effort has been divided between extending the model and in exercising the existing model to both exemplify expected phenomena and to compare with available observations. The model has been extended: to remove the hydrostatic approximation; to incorporate condensation and radiation into the two-dimensional, unsteady model; to incorporate terrain variation into the surface boundary conditions; and to determine the influence of particle size on the turbulent transport of aerosols. Sample calculations include fog episodes, diurnal variation of stratus over the ocean, the general structure of the tradewind boundary layer, and an evaporatively cooled gust front. Although verification tests have not been adequate to provide a detailed assessment of accuracy, the model results are generally quite consistent with available observations. Author (GRA)

N78-18634# Air Force Geophysics Lab., Hanscom AFB, Mass.
THE DISTRIBUTION OF THUNDERSTORM DAYS, LIGHTNING DISCHARGES, AND THE INCIDENCE OF LIGHTNING DISCHARGE DERIVED FROM VLF SFERICS DATA
William B. Freeman, Jr. 17 May 1977 88 p refs
(AD-A048271; AFGL-TR-77-0112; AFGL-SR-203) Avail: NTIS HC A05/MF A01 CSCL 20/14

Distributions were developed for 1972 in the Eastern Hemisphere of thunderstorm days (January, April, July, and October), the incidence of lightning discharge (January and April), and the areal concentration of lightning discharge (yearly). These analyses were based on a review of sferics data. Charts of thunderstorm days differed significantly from mean charts of the World Meteorological Organization (WMO), especially over the oceans, North Africa, Arabia, the Mediterranean Sea, and Southeast China. These areas of sparse data in the WMO compilation have been covered in this investigation. The tentative, first estimate of the distribution of lightning discharges over a large area of earth differed significantly from the distribution of thunderstorm days for April and July, but the two distributions were similar for January and October. Centers of relatively high occurrence of lightning discharge on a yearly basis were located over South Africa, the Mediterranean Sea, Arabia, Southeast China, Southeast Asia, and Australia. The occurrence of lightning discharge was shown to follow Sun northward from January to the maximum poleward thrust in July. The occurrence of lightning discharge receded equatorward from July to the end of fall in December. The most reliable planetary-scale estimate of the average incidence of lightning discharge was 0.000042 per km per sec for the Northern Hemisphere (0-179E) in January 1972 and 0.000030 per km per sec for April 1972. GRA

N78-18635# Colorado State Univ., Fort Collins.
TROPICAL CYCLONE RESEARCH BY DATA COMPOSITING
William M. Gray and William M. Frank Jul. 1977 73 p refs
(Contract N00228-76-C-2129)
(AD-A048168; NEPRF-TR-77-01) Avail: NTIS HC A04/MF A01 CSCL 04/2

This paper presents the results of recent tropical cyclone research at Colorado State University (CSU). Particular attention is paid to new findings which impact storm forecasting and modeling efforts. Observational studies using large amounts of composited rawinsonde, satellite and aircraft flight data have been performed to analyze tropical cyclone dynamics, energetics, intensity, intensity change, and motion. The genesis of storms from earliest stage cloud clusters was also analyzed. Numerical modeling studies on cloud cluster dynamics and the intensification of pre-storm clusters are underway. Future research in all of the above areas is planned to exploit fully the very large tropical cyclone data set which has been assembled at CSU.
Author (GRA)

N78-18636# Battelle Columbus Labs., Ohio.
METEOROLOGICAL SATELLITE OBSERVATIONS AND ARMY OPERATIONS Final Report, 27 Oct. 1976 - 31 Mar. 1977
T. T. Fujita Ft. Monmouth, N. J. ECOM Jul. 1977 41 p

Prepared in cooperation with Chicago Univ., Ill.
(Grant DAAG29-76-D-0100; DA Proj. 1T1-62111-AH-71)
(AD-A048157; ECOM-77-6) Avail: NTIS HC A03/MF A01 CSCL 04/2

Determination of rainfall from satellite data requires the examination of the following features: (1) Watch for a rapid growth of the anvil cloud. It is a clear indication of strong updrafts inside the cloud. (2) Determine the motion of the head area on the upwind side. If the upwind side does not drift fast, or even stays at the same spot, it is an indication of a giant storm standing against the steering winds. (3) Rainfall does not end when the overshooting tops disappear. A ground truth experiment for interpretation of SMS/GOES data is presented. Included are: (1) techniques for cloud growth analyses from successive pictures, (2) development of a time lapse whole sky photograph program, and (3) the solution of camera calibrations that relate to the cloud height and growth computations.
Author (GRA)

N78-18637# Air Force Systems Command, Wright-Patterson AFB, Ohio.
TRANSACTIONS OF THE 8TH ALL-UNION CONFERENCE ON CLOUD PHYSICS AND ACTIVE MODIFICATIONS (SELECTED ARTICLES)
15 Jul. 1977 99 p Transl. into ENGLISH from Tr. VIII Vsesoyuznoy Konferentsii po Fizike Oblakov i Aktivnym Vozdeystviyam (USSR), 1970 p 48-55, 77-83, 93-100, 308-318 and 470-475
(AD-A048653; FTD-ID(RS)T-1156-77) Avail: NTIS HC A05/MF A01 CSCL 04/1

Contents: Cloud Condensation Nuclei; Properties of Active Condensation Nuclei; The Total Spectrum of Particles of Natural Aerosols and Estimate of the Fraction of Active Condensation Nuclei; Some Results of Studies of the Reaction of Water Aerosol with Particles of a Solid Reagent; and Integral Equation of the Kinetic Theory of the Coagulation of Cloud Particles. GRA

N78-18638# Florida State Univ., Tallahassee. Dept. of Statistics.
BIBLIOGRAPHY OF STATISTICAL AND METEOROLOGICAL METHODOLOGY IN WEATHER MODIFICATION, II
Morgan A. Hanson, Lawrence E. Barker, and Charles H. Hunter Oct. 1977 63 p Suppl. to FSU-STATISTICS-M388
(AD-A048686; FSU-STATISTICS-M440; ONR-TR-126) Avail: NTIS HC A04/MF A01 CSCL 04/2

This collection of abstracts is supplementary to the Bibliography of Statistical and Meteorological Methodology in Weather Modification by Morgan A. Hanson, Charles L. Bach, and Edward A. Cooley issued as Florida State University Department of Statistics Report No. M388, September 1976. Motivation for the bibliography arose in association with an Office of Naval Research sponsored contract in the design and analysis of weather experimentation. GRA

N78-18639# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
WHITE SANDS MISSILE RANGE CLIMATE CALENDAR
David J. Novlan Oct. 1977 31 p
(DA Proj. 1T6-65702-D-127)
(AD-A048305; DR-948) Avail: NTIS HC A03/MF A01 CSCL 04/2

This is the seventh edition of the White Sands Missile Range Climate Calendar, which was first published in May 1963. Mean daily maximum and minimum temperatures, and extreme temperatures for the period of record (1950-1976) are tabulated in calendar form for A Station, the forecast center located at Headquarters, White Sands Missile Range, New Mexico. Averages of temperatures, relative humidity, wind and cloudiness are included for each month, as well as maximum 24-hour and monthly rainfall. Supplementary tables give monthly, seasonal and annual values of maximum winds, degree days, solar radiation, means and extremes of station pressure, the greatest monthly and single-storm snowfall, and the average six-hourly relative humidities. Also included are the average number of days with the occurrence of precipitation, distant lightning, thunderstorms, and visibility restrictions. Author (GRA)

N78-18640# Army Electronics Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
THE 14818C LANCE MISSILE NUMBER 3292, ROUND NUMBER 298 APT, 24 AUGUST 1977
Sep. 1977 27 p
(AD-A048321; DR-943) Avail: NTIS HC A03/MF A01 CSCL 04/1

Meteorological data gathered for the launching of 14818C Lance, Missile Number 3292, Round Number 298 APT, are presented in tabular form. Author (GRA)

N78-18641# National Severe Storms Lab., Norman, Okla.
APPLICATION OF DOPPLER WEATHER RADAR TO TURBULENCE MEASUREMENTS WHICH AFFECT AIRCRAFT Final Report
J. T. Lee Mar. 1977 51 p refs
(Contract DOT-FA74WAI-495)
(AD-A048603; NSSL-1; FAA-RD-77-145) Avail: NTIS HC A04/MF A01 CSCL 04/2

Analysis of thunderstorm turbulence hazardous to aircraft operation and coordinated Doppler radar observations indicate a high potential for Doppler radar utilization particularly the mean velocity spectrum breadth observations in defining severe turbulence areas. The mean Velocity Processor (MVP, the first real-time display of Doppler radar data) and the Multi-moment Ling Display (MMD), both developed at NSSL, are utilized with the radars to study vortex motion, turbulence, and wind shear areas. In addition, the Plan Shear Indicator (PSI) developed by the Air Force Cambridge Research Laboratory (AFCRL) was also employed. A number of severe convective storms were penetrated by an instrumented aircraft directed into areas which analysis inferred to be turbulent. Aircraft recorded turbulence and concurrent Doppler data are compared. Utilization of the spectrum breadth calculated from the mean velocity data as a turbulence signature is discussed. Vortex motion signature is also defined.
Author (GRA)

N78-18642# Army Electronics Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
METEOROLOGICAL DATA REPORT. 12828F LANCE MISSILE NO. 2215, ROUND NO. 302 RSL, 6 OCTOBER 1977
Nov. 1977 36 p
(DA Proj. 1T6-65702-D-127)
(AD-A048273; DR-947) Avail: NTIS HC A03/MF A01 CSCL 04/2

Meteorological data gathered for launching of 12828F Lance, missile number 2215, round number 302 rsl, are presented in tabular form. Author (GRA)

N78-18643# Army Electronics Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
METEOROLOGICAL DATA REPORT. 14821A LANCE MISSILE NO. 3296, ROUND NO. 303 APT, 10 NOVEMBER 1977
Nov. 1977 38 p
(DA Proj. 1T6-65702-D-127)
(AD-A048272; DR-950) Avail: NTIS HC A03/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 14821A Lance, Missile Number 3296, Round Number 303 APT, are presented in tabular form. Author (GRA)

N78-18644# World Meteorological Organization, Geneva (Switzerland).
COMPENDIUM OF TRAINING FACILITIES IN ENVIRONMENTAL PROBLEMS RELATED TO METEOROLOGY AND OPERATIONAL HYDROLOGY
1977 200 p
(WMO-489; ISBN-92-63-10489-1) Avail: NTIS HC A09/MF A01; WMO, Geneva

The details of courses available in WMO member countries include the place and nature of the instruction, the language and duration of course, entrance qualifications, tuition fees, condensed syllabus and address for further information. ESA

N78-18645# World Meteorological Organization, Geneva (Switzerland).

GUIDE TO MARINE METEOROLOGICAL SERVICES
1977 148 p Original contains color illustrations
(WMO-471; ISBN-92-63-10471-9) Avail: NTIS HC A07/MF A01; WMO, Geneva

The scope of the WMO marine meteorological program is outlined together with national marine meteorological activities. Requirements for marine meteorological services and an international program of marine meteorological services for the high seas are given. The WMO voluntary observing ships' scheme is detailed and marine instrumentation and observing practices are detailed. A summary of marine climatology is given. ESA

N78-18646# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.
METHODS FOR INDIRECT WIND MEASUREMENT [MESSMETHODEN ZUR INDIREKTEN BESTIMMUNG DES WINDES]
F. Koepp and C. Werner 28 Jul. 1977 22 p refs In GERMAN
(DLR-IB-553-77/5) Avail: NTIS HC A02/MF A01

A survey of indirect methods of wind velocity measurement based on laser and acoustic applications is presented. The laser methods discussed are: the eddy correlation method with transit time lidar, the scintillation method, and the laser Doppler method. The acoustic methods are based on sound detecting and ranging. The applications cover wind shear and wake turbulence determination, clear air turbulence, and diffusion measurements, as well as wind vector- and crosswind measurements. ESA

N78-18647# Royal Netherlands Meteorological Inst., De Bilt.
A NETWORK OF LIGHTNING COUNTERS IN THE NETHERLANDS
H. R. A. Wessels 1977 77 p refs
(KNMI-WR-77-6) Avail: NTIS HC A05/MF A01

The design and first results of a network of 18 lightning counters are described. The main purpose of these counters is to determine the average number of lightning strokes to the ground per unit area and unit time. The instrument used is a transistorized CCIR-type of counter responding to field variations exceeding 3 kHz. Methods for determining the effective range of these counters are described. A first estimate of the average earth stroke density is given to be about two strokes per square km per year. A comparison is made between the thunder heard observing system and counter results. Recordings of the network on two occasions with severe hailstorms are discussed. Some climatological results for the years 1974 to 1976 are given. ESA

N78-18648# Royal Netherlands Meteorological Inst., De Bilt.
PRACTICAL USE OF TRANSITIONAL RULES FOR FORECASTING THE MONTHLY MEAN TEMPERATURE AT DE BILT [PRAKTISCH GEBRUIK VAN OVERGANGSREGELS TEN BEHOEVE VAN DE VERWACHTING VAN DE MAANDGEMIDDELDE TEMPERATUUR TE DE BILT]
H. M. VandenDool and J. L. Nap 1977 13 p refs In DUTCH
(KNMI-V-290) Avail: NTIS HC A02/MF A01

The transitional rules for forecasting monthly mean temperatures at De Bilt, based on mean temperatures of the previous month (T30), were examined for practical cases. The classification of T30 in only three classes (warm, normal, and cold) was found to be too coarse. A solution is given for more gradual variations of the temperature interval for the coming month. Optimization of the performance index leads to varying lengths of temperature intervals to be used. This problem is also discussed and resolved. All rules were derived for the period 1735 to 1975. The climatology of this period deviates excessively from that of the period normally considered, i.e., 1931 to 1960. A compromise was made in selecting the period 1881 to 1970. ESA

N78-18649# World Meteorological Organization, Geneva (Switzerland).
COMPENDIUM OF METEOROLOGICAL TRAINING FACILITIES, FIFTH EDITION
1977 372 p refs
(WMO-240) Avail: NTIS HC A16/MF A01; WMO, Geneva

Information on meteorological training courses in some 90 countries is given. Details are presented of training facilities, regular and/or ad-hoc training, and addresses for further information. In addition, information on course contents, fees, qualifications, course duration, etc., is given. ESA

N78-18650# World Meteorological Organization, Geneva (Switzerland).
COMPENDIUM OF METEOROLOGY. VOLUME 2, PART 1: GENERAL HYDROLOGY
A. I. Chebotarev and Aksel Wiin-Nielsen, ed. 1977 49 p refs
(WMO-364) Avail: NTIS HC A03/MF A01; WMO, Geneva

Lecture notes in general hydrology based on corresponding syllabi for the fundamental training of class 1 and class 2 personnel are given. The following areas are covered: water cycles and water balance; measurements and methods of measuring; flowing waters; standing waters; and methods of analysis. ESA

N78-18651# World Meteorological Organization, Geneva (Switzerland).
WORLD WEATHER WATCH. INTERNATIONAL GLOBAL DATA-PROCESSING SYSTEM PLAN TO SUPPORT THE FIRST GARP GLOBAL EXPERIMENT
1977 79 p refs
(WMO-469; ISBN-92-63-10469-7) Avail: NTIS HC A05/MF A01; WMO, Geneva

The International Global Data-processing System Plan to support the First GARP Global Experiment (FGGE) is described, together with the format to be used for international exchange of data sets. ESA

N78-18652# World Meteorological Organization, Geneva (Switzerland).
HYDROLOGICAL APPLICATION OF ATMOSPHERIC VAPOUR-FLUX ANALYSES
E. M. Rasmusson 1977 59 p refs
(WMO-476; OHR-11; ISBN-92-63-10476-X) Avail: NTIS HC A04/MF A01; WMO, Geneva

A mathematical analysis of atmospheric vapor flux and its relationship to the land phase of the hydrological cycle are presented. The possibility of evaluating atmospheric water-budgets at small scales is discussed, and examples of the necessary computations are given. The continuing usefulness of rawinsonde over satellite measurements of wind and humidity are noted. ESA

N78-18653# Fondazione Ugo Bordoni, Rome (Italy).
EXPERIMENTAL MEASUREMENTS FOR THE EVALUATION OF THE ACCURACY OF TIPPING-BUCKET RAIN GAUGES USED IN THE RESEARCH PROGRAM ON RADIO PROPAGATION FREQUENCIES ABOVE 10 GHz
F. Barbaliscia, F. Fedi, and U. Merlo 12 Apr. 1976 21 p refs
Avail: NTIS HC A02/MF A01

The results of experimental measurements carried out to evaluate the accuracy obtainable with tipping-bucket rain gages for the measurement of rainfall intensity both in the Fucino Experimental Installation and in a number of locations throughout the national territory are presented. These measurements are carried out within the framework of the research program on radio propagation at frequencies above 10 GHz under way in Italy. The tipping-bucket rain gage, the type most widely used by the Italian Meteorological Service for the measurement of hourly and daily rainfall height, is described briefly. Measurements carried out in the laboratory on ten such rain gages are illustrated. The purpose of these measurements was to evaluate measurement accuracy of average rainfall intensity also in conditions in which the maximum response rapidity allowed by the instrument is fully utilized. Author (ESA)

N78-18654# Fondazione Ugo Bordoni, Rome (Italy).
METHOD OF MEASUREMENT OF RAINFALL INTENSITY WITH THE COMBINED USE OF CAPACITOR AND TIPPING-BUCKET RAIN GAUGES
F. Fedi, U. Merlo, and B. Peroni 20 Apr. 1977 55 p refs
Avail: NTIS HC A04/MF A01

The combined use of the two instruments connected to a suitable data acquisition unit constitutes a measurement system with the accuracy and stability of the tipping-bucket rain gage

and the rapid response of the capacitor rain gage. Using the proposed method, it is possible for each rainy event, to calibrate in real time and with natural rain the capacitor rain gage with the tipping-bucket rain gage and to overcome, therefore, the above-mentioned limitations of each of the two instruments. Some examples of applications of the method in the measurement of natural rainfall intensity are illustrated. These measurements were carried out in Rome in the summer-autumn of 1975 using two systems of measurement placed one beside the other, each composed of a tipping-bucket rain gage, a capacitor rain gage, and a data acquisition unit. Author (ESA)

N78-18655# National Bureau of Standards, Washington, D. C. Thermal Engineering Section.
ESTIMATING THE ENERGY CONSERVATION POTENTIAL OF VENTILATION CONTROL THROUGH WEATHER DATA ANALYSIS Final Report
T. Kusuda and J. W. Bean Aug. 1977 52 p refs Sponsored by FEA
(PB-273949/8; NBSIR-76-1088) Avail: NTIS HC A04/MF A01 CSCL 04B

Hourly weather data for six selected cities in the United States covering eleven consecutive years were analyzed to aid in estimating the possible energy saving that could be achieved by closing the outdoor dampers during unoccupied hours. Hourly temperature and enthalpy values were presented in histogram form for occupied and unoccupied periods with the suggestion that similar data processing be carried out for other cities as well. Author

N78-18656# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
A DUAL DOPPLER RADAR STUDY OF THE URBAN BOUNDARY LAYER: A SUMMARY OF METROMEX RESULTS
Robert A. Kropfli Sep. 1977 146 p refs
(PB-275346/5; NOAA-TM-ERL-WPL-26; NOAA-77110802) Avail: NTIS HC A07/MF A01 CSCL 04B

Motions in the planetary boundary layer were observed on clear convective afternoons. The scope was limited to seven days in which chaff was used as tracers of air motions in the clear Planetary Boundary Layer (PBL). A summary of all data taken and a general description of the experimental procedures and data processing are given. GRA

N78-18657# National Weather Service, Fort Worth, Tex. Scientific Services Div.
A SNOW INDEX USING 200mb WARM ADVECTION
Billie J. Cook Oct. 1977 21 p refs
(PB-275184/0; NOAA-TM-NWS-SR-93; NOAA-77110404) Avail: NTIS HC A02/MF A01 CSCL 04B

Warm advection at 200mb was used to forecast the amount of snowfall in the ensuing 24 hours. The type of advection at 700mb was used to modify the forecast. A test of the method was made for one year with favorable results. GRA

N78-18658# Bureau of Reclamation, Denver, Colo. Engineering and Research Center.
ATMOSPHERIC SIMULATION USING STRATIFIED LIQUID MODELS
H. T. Falvey and R. A. Dodge Jul. 1977 101 p refs
(PB-274529/7; REC-ERC-77-8) Avail: NTIS HC A06/MF A01 CSCL 04B

Analytical and laboratory studies were made to demonstrate the feasibility of using stratified liquids and distorted scale maps of an area to simulate mesoscale atmospheric phenomena. Techniques and instrumentation were developed for creating velocity gradients, creating density gradients, for visualization, and for making measurements. The effectiveness of both aerial and ground seeding station locations was investigated for various pilot study areas of Project Skywater. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N78-18659 Texas A&M Univ., College Station.
REFLECTION AND REFRACTION OF SOLITARY WAVES: A NUMERICAL INVESTIGATION Ph.D. Thesis
Gerald Thomas Hebenstreit 1977 121 p
Avail: Univ. Microfilms Order No. 77-32164

Solitary waves were used as an unambiguous tool for the initial study of the propagation of long, nonlinear, dispersive water waves. A numerical model, based on an appropriate set of equations for approximating these waves in two horizontal dimensions over variable bottom topography was used to study the reflection of solitary waves from vertical barriers and the refraction of solitary waves due to changing water depth. The results of the reflection tests showed that the model could be used to successfully simulate the Mach reflection phenomenon observed in wave tank studies. The results of the refraction tests showed that solitary waves do not seem to refract in the manner predicted by refraction theory as applied to long linear waves. Dissert. Abstr.

N78-18660 Connecticut Univ., Storrs.
NON-LINEARLY INDUCED RESIDUAL CURRENTS IN TIDALLY DOMINATED ESTUARIES Ph.D. Thesis
John Peter Lanniello 1977 313 p
Avail: Univ. Microfilms Order No. 77-31185

Two dimensional analytic solutions are derived for the long term averaged currents induced in nearshore tidal channels or estuaries by the non linear interactions of the periodic tides. Solutions are found for channels with rectangular cross sections and arbitrary longitudinal breadth and depth variations; the turbulence is represented by a vertically variable coefficient of eddy viscosity. Dissert. Abstr.

N78-18661*# National Oceanic and Atmospheric Administration, Miami, Fla. Oceanographic and Meteorological Labs.
DEEP SEA TIDES DETERMINATION FROM GEOS-3 Final Report
George A. Maul and Alan Yanaway Feb. 1978 27 p refs
(NASA Order P-57579-G)
(NASA-CR-141435) Avail: NTIS HC A03/MF A01 CSCL 08C

GEOS 3 altimeter data in a 5 deg X 5 deg square centered at 30 deg N, 70 deg W were analyzed to evaluate deep sea tide determination from a spacecraft. The signal to noise ratio of known tidal variability to altimeter measurement of sea level above the ellipsoid was 0.1. A sample was obtained in a 5 deg x 5 deg area approximately once every four days. The randomly spaced time series was analyzed using two independent least squares techniques. Author

N78-18662*# Wentz (Frank J.) and Associates, Cambridge, Mass.
A TWO-SCALE SCATTERING MODEL WITH APPLICATION TO THE JONSWAP '75 AIRCRAFT MICROWAVE SCATTEROMETER EXPERIMENT Final Report
Frank J. Wentz Dec. 1977 127 p refs
(Contract NAS1-14330)
(NASA-CR-2919) Avail: NTIS HC A07/MF A01 CSCL 08J

The general problem of bistatic scattering from a two scale surface was evaluated. The treatment was entirely two-dimensional and in a vector formulation independent of any particular coordinate system. The two scale scattering model was then applied to backscattering from the sea surface. In particular, the model was used in conjunction with the JONSWAP 1975 aircraft scatterometer measurements to determine the sea surface's two scale roughness distributions, namely the probability density of the large scale surface slope and the capillary wavenumber spectrum. Best fits yield, on the average, a 0.7 dB rms difference between the model computations and the vertical polarization measurements of the normalized radar cross section. Correlations between the distribution parameters and the wind speed were established from linear, least squares regressions. Author

N78-18663# Holosonics, Inc., Richland, Wash.
A FEASIBILITY STUDY FOR THE DEVELOPMENT OF A NUCLEAR MOISTURE DENSITY MEASUREMENT SYSTEM FOR MARINE USE Final Report, 15 Jun. - 11 Nov. 1977
Richard C. Edwards and Gerald L. Fitzpatrick 28 Dec. 1977

66 p refs
(Contract N00014-77-C-0394)
(AD-A048665) Avail: NTIS HC A04/MF A01 CSCL 08/13

A gamma-gamma through-transmission moisture-density measurement technique is postulated for marine sediment studies. The technique uses two gamma sources of different energies with a fixed distance between the sources and the detector. By obtaining a grab sample for system calibration, the measurement in the postulated system is due only to the random emission of the radiation sources. The technique should provide moisture measurement accuracies of + or - 1.1% at 15% and + or - 16% at 500% contained moisture. Author (GRA)

N78-18664# Oregon State Univ., Corvallis. School of Oceanography.
MIXED LAYER OBSERVATIONS DURING THE NORPAX POLE EXPERIMENT
James J. Simpson and Clayton A. Paulson Aug. 1977 169 p refs
(Contracts N00014-67-A-0369-0007;
N00014-67-A-0369-0012; N00014-76-C-0067;
N00014-75-C-0299; NR Proj. 083-102)
(AD-A048581; DATA-66) Avail: NTIS MF A01 CSCL 08/10

This report contains observations made from R/P FLIP as part of the first process-oriented NORPAX (North Pacific Experiment) experiment. The experiment was named 'POLE' to indicate that the horizontal extent of sampling was small compared to the largest scale investigated in NORPAX. The part of the experiment reported here was conducted during the period 28 Jan through 14 Feb 1974. During this time, FLIP occupied a station approximately 800 miles north of the Hawaiian Island Chain (35 deg N. lat, 155 W. long) under free drift conditions. Direct measurements of the incident solar, reflected solar, net all-wave and net long-wave fluxes were made from R/P FLIP 2-14 Feb 1974. The sea surface temperature was also observed with a radiation thermometer. Standard meteorological observations, from which the latent and sensible heat fluxes from the sea surface to the atmosphere were derived, also were made during this period. Vertical profiles of temperature and salinity were taken from R/P FLIP 30 Jan-14 Feb 1974. Profiling was concentrated in the mixed layer and thermocline. The maximum depth reached was 325 meters. On average, 8 profiles were measured per day. GRA

N78-18665# Naval Oceanographic Office, Washington, D. C.
VARIABILITY OF OCEANOGRAPHIC CONDITIONS AT OCEAN WEATHER STATIONS IN THE NORTH ATLANTIC AND NORTH PACIFIC OCEANS
William H. Beatty, III Jun. 1977 89 p refs
(AD-A048730; NOO-TN-3700-67-77) Avail: NTIS HC A05/MF A01 CSCL 08/11

Seasonal mean salinity, temperature, and sound velocity and their variability were determined for 12 ocean weather stations. Variability above 200m depths is caused by wind-induced mixing and upwelling, advection and radiational heating and cooling. Below 200m internal waves and ocean fronts cause the variability. Author (GRA)

N78-18666# Naval Postgraduate School, Monterey, Calif.
THE KINEMATICS OF BREAKING WAVES IN THE SURF ZONE M.S. Thesis
Alfred James Olsen Sep. 1977 78 p refs
(AD-A048723) Avail: NTIS HC A05/MF A01 CSCL 08/3

Simultaneous measurements of sea surface elevation and onshore and alongshore water particle velocities were measured at three locations within the surf zone using two capacitance type penetrating wave staffs and three two-component electromagnetic flow meters. The probability density functions, pdf, for the sea surface elevation were always highly positively skewed, whereas the pdf's for the velocities were both negatively and positively skewed. Mean values of the onshore and alongshore components of flow reflected the influence of a rip current frequently observed just south of the instrument locations. Strong harmonics in the spectra of sea surface fluctuations and particle velocities infer nonlinear conditions. Coherence values between waves and onshore flow were high, ranging above 0.9. The coherence between waves and onshore flow was used to separate the turbulence and wave-induced velocity components. Over the range of collapsing to spilling breakers a reasonable value for the ratio of turbulent to wave-induced velocity was determined to be approximately 0.75. Saturation regions were found in the wave and velocity energy-density spectra at higher frequencies as evidenced by -5 and -3 slopes, respectively. Author (GRA)

N78-18667# Massachusetts Office of Coastal Zone Management, Boston.
MASSACHUSETTS COASTAL ZONE MANAGEMENT PROGRAM, VOLUME 1
Mar. 1977 602 p
(PB-274031/4; NOAA-77092106) Avail: NTIS HC A99/MF A01 CSCL 13B

A description of the landward and seaward boundaries of the Massachusetts coastal zone and a summary of how the CZM policies apply to the areas and activities within these boundaries are given. A series of sections present long term state coastal policies on the resources of the coastal zone and the primary uses of the coastal zone. An in depth analysis of coastal zone management under existing institutional and administrative structures is included. The central issue is how to implement broad coastal policies in moving from planning to action. GRA

N78-18668# Texas A&M Univ., College Station. Dept. of Oceanography.
OCEANOGRAPHIC STATION DATA COLLECTED ABOARD R/V MELVILLE DURING FDRAKE 75
W. D. Nowlin, T. Whitworth, III, L. E. Gordon, and G. C. Anderson May 1977 360 p
(Grant NSF-ID074-14941-A01)
(PB-274442/3; TAMU-REF-77-2-D; NSF/IDOE-77/161) Avail: NTIS HC A16/MF A01 CSCL 08J

During the months of January, February and March of 1975, three oceanographic research vessels participated in the First Dynamic Response and Kinematics Experiment (FDRAKE). The vessels were: R/V CONRAD, R/V MELVILLE and ARA ISLAS ORCADAS. The tracks of the three ships were shown. Each vessel made hydrographic stations, dropped expendable bathythermographs (XBT's) and collected underway oceanographic and meteorological data. The MELVILLE was also used to deploy a moored array of current, temperature and tide recorders. Some of the moorings were recovered during FDRAKE 75; the remainder was set as a year long array and recovered during FDRAKE 76. The hydrographic bottle and STD data collected aboard the MELVILLE were presented. GRA

N78-18669# Royal Netherlands Meteorological Inst., De Bilt.
SEA SURFACE TEMPERATURE DETERMINATION FROM INFRARED RADIATION. A CRITICAL EVALUATION OF THE METHOD
C. Kraan 1977 116 p refs In DUTCH; ENGLISH summary
(KNMI-WR-77-5) Avail: NTIS HC A06/MF A01

Ten experimental flights with an infrared radiation thermometer (Barnes PRT-5) were carried out in various seasons over a sea area adjacent to the Netherlands coast 100 km long and 20 km wide in order to assess the value of this method of sea temperature measurement in connection with the study of coastal water circulation. It is concluded that the accuracy to which the mixed layer temperature can be determined is less than could be deduced from many literature data. The calibration procedure for the instrument was improved. From a comparison between six published correction methods for obtaining the skin temperature from the instrument signal it is concluded that those proposed by Tien (1974) and by Shaw and Irbe (1972) are most suitable. It is shown that the distribution of sea surface temperature over this coastal area within one tidal period can be reasonably well represented (with a standard random error of 0.4 C) in a digital grid with a mesh size of 1.5 km. Author (ESA)

N78-18670# Delaware Univ., Newark. Sea Grant Coll. Program.
NEW CASTLE COUNTY DELAWARE RIVER SHORELINE STUDY Final Report
Richard Agnello, Lawrence Donnelley, Richard Kirk, Paul Jensen, and Charles Brine 1977 206 p refs Sponsored by NOAA Prepared for New Castle County Dept. of Parks and Recreation, Del., and Delaware River Shoreline Comm.

(PB-275317/6; DELISG-18-77; NOAA-77110409) Avail: NTIS HC A10/MF A01 CSCL 05K

Tasks are described which include a review and analysis of water-based recreation demand, a literature survey of water-based recreation facilities in American cities and an evaluation of shoreline locations for their suitability as water-based recreation sites. These tasks were synthesized into a set of five recreation development scenarios which are alternatives to be evaluated in a public survey. A workshop held to discuss progress on the previous tasks is reported and survey results are analyzed. GRA

N78-18671# Old Dominion Univ., Norfolk, Va. Inst. of Oceanography.

HYDRAULIC SENSOR INSTRUMENTATION OF A SHORE FACE IN A TIDAL CURRENT CONVERGENCE ZONE: CAPE HENRY, VIRGINIA Final Report

John C. Ludwick and Preston B. Johnson Jun. 1977 185 p refs

(Grant NOAA-04-4-022-17)

(PB-275247/5; TR-25; NOAA-77110312) Avail: NTIS HC A09/MF A01 CSCL 08C

The question as to whether coastal currents were competent to erode unconsolidated and semiconsolidated sediments of sand size on the inner continental shelf was examined. The basic data gathering technique employed a rigid instrument platform installed on the sea floor. An armored cable was used to transmit sampled data to recording instruments on shore. The advantages and disadvantages of this system were compared with conventional techniques of using surface vessels, radio-link buoys, and self-contained recording and storage within the sensor housing for periodic retrieval. The design, operation, and installation of the measurement system are discussed in detail. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N78-18672*# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Biomedical Engineering.

EFFECT OF SURFACE TEXTURE BY ION BEAM SPUTTERING ON IMPLANT BIOCOMPATIBILITY AND SOFT TISSUE ATTACHMENT Annual Report

Donald F. Gibbons Dec. 1977 15 p refs

(Grant NsG-3126)

(NASA-CR-135311; AR-1) Avail: NTIS HC A02/MF A01 CSCL 06C

The objectives in this report were to use the ion beam sputtering technique to produce surface textures on polymers, metals, and ceramics. The morphology of the texture was altered by varying both the width and depth of the square pits which were formed by ion beam erosion. The width of the ribs separating the pits were defined by the mask used to produce the texture. The area of the surface containing pits varies as the width was changed. The biological parameters used to evaluate the biological response to the texture were: (1) fibrous capsule and inflammatory response in subcutaneous soft tissue; (2) strength of the mechanical attachment of the textured surface by the soft tissue; and (3) morphology of the epidermal layer interfacing the textured surface of percutaneous connectors. Because the sputter yield on teflon ribs was approximately an order of magnitude larger than any other material the majority of the measurements presented in the report were obtained with teflon. Author

N78-18673*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

DESIGN OF A BLOOD-FREEZING SYSTEM FOR LEUKEMIA RESEARCH

Thomas E. Williams and Thomas A. Cygnarowicz Feb. 1978 43 p refs

(NASA-TP-1165; G7702-F-9) Avail: NTIS HC A03/MF A01 CSCL 06E

Leukemia research involves the use of cryogenic freezing and storage equipment. In a program being carried out at the National Cancer Institute (NCI), bone marrow (white blood cells) was frozen using a standard cryogenic biological freezer. With this system, it is difficult to maintain the desired rate of freezing and repeatability from sample to sample. A freezing system was developed that satisfies the requirements for a repeatable, constant freezing rate. The system was delivered to NCI and is now operational. This report describes the design of the major subsystems, the analyses, the operating procedure, and final system test results. Author

N78-18674*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

METHOD AND APPARATUS FOR ELIMINATING LUMINOL INTERFERENCE MATERIAL Patent Application

Eldon Jeffers (Boeing Aerospace Co., Houston, Tex.) and R. R. Thomas, inventors (to NASA) (Boeing Aerospace Co., Houston, Tex.) Filed 9 Feb. 1978 27 p Sponsored by NASA

(NASA-Case-MSC-16260-1; US-Patent-Appl-SN-876440) Avail: NTIS HC A02/MF A01 CSCL 06M

A method was developed for automatically and rapidly making determinations of the total number of bacteria, alive and dead, present in a fluid sample, by using the iron porphyrin assay method. The method provides for eliminating luminescent interference caused by the reaction of luminol with common inorganic interfering agents such as metallic ions and organic interfering agents such as extracellular porphyrin. The reliability of the iron porphyrin is thereby increased by inactivating soluble iron porphyrins in the sample which are unrelated to the bacteria in the sample, but which would luminescently react with luminol to interfere with the assay. NASA

N78-18675# Florida State Univ., Tallahassee. Dept. of Chemistry.

HIGH SENSITIVITY FOURIER TRANSFORM NMR. INTERMOLECULAR INTERACTIONS BETWEEN ENVIRONMENTAL TOXIC SUBSTANCES AND BIOLOGICAL MACROMOLECULES Technical Report, 2 Oct. 1974 - 1 Oct. 1976

George C. Levy Sep. 1977 96 p refs

(Grant EPA-803095)

(PB-274011/6; EPA-600/1-77-045) Avail: NTIS HC A05/MF A01 CSCL 06A

The feasibility of developing techniques for evaluation of the effects of environmental toxic materials on complex biopolymer systems using high sensitivity Fourier Transform Nuclear Magnetic Resonance (NMR) spectroscopy was explored. Spectral sensitivity was to be increased especially for the 13 C and other nuclides having low magnetogyric ratios. Initially, modifications to an existing Bruker HX-270 spectrometer provided moderate improvement in sensitivity for 13 C and substantial sensitivity increase for 15 N observation. Author

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N78-18676 California Univ., Los Angeles.

A NEW MODEL OF NERVE ACTION POTENTIAL AND THE EXISTENCE OF A PULSE SOLUTION Ph.D. Thesis

Jonathan George Bell 1977 113 p

Avail: Univ. Microfilms Order No. 77-25325

A mathematical model was developed which describes the propagation of electrical impulses down the axon of a nerve cell. The dynamics of sodium and potassium processes are described in the model by two linear, ordinary differential equations of third order for sodium and second order for potassium. These equations have coefficients that depend nonlinearly on voltage, which is governed by a parabolic partial differential equation. A mechanical spring-mass-dashpot system is presented which generates the initial conditions for the ordinary differential equations. Dissert. Abstr.

N78-18677*+ National Aeronautics and Space Administration, Washington, D. C.

AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 175

Jan. 1978 79 p

(NASA-SP-7011(175)) Avail: NTIS E02 CSCL 06E

This bibliography lists 239 reports, articles, and other documents introduced into the NASA scientific and technical information system in December 1977. Author

N78-18678*# Iowa Univ., Iowa City. Dept. of Medicine
INFLUENCE OF CENTRAL VENOUS PRESSURE UPON SINUS NODE RESPONSES TO ARTERIAL BAROREFLEX STIMULATION IN MAN
Allyn L. Mark, Akira Takeshita, Dwain L. Eckberg, and Francois M. Abbound 1978 25 p refs
(Grants NsG-9060; HL-14388; HL-18083)
(NASA-CR-155783) Avail: NTIS HC A02/MF A01 CSCL 06P

Measurements were made of sinus node responses to arterial baroreceptor stimulation with phenylephrine injection or neck suction, before and during changes of central venous pressure provoked by lower body negative pressure or leg and lower truck elevation. Variations of central venous pressure between 1.1 and 9.0 mm Hg did not influence arterial baroreflex mediated bradycardia. Baroreflex sinus node responses were augmented by intravenous propranolol, but the level of responses after propranolol was comparable during the control state, lower body negative pressure, and leg and trunk elevation. Sinus node responses to very brief baroreceptor stimuli applied during the transitions of central venous pressure also were comparable in the three states. The authors conclude that physiological variations of central venous pressure do not influence sinus node responses to arterial baroreceptor stimulation in man. Author

N78-18679# Joint Publications Research Service, Arlington, Va.
SPACE BIOLOGY AND AEROSPACE MEDICINE, NO. 5, 1977
O. G. Gazenko, ed. 10 Nov. 1977 127 p refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), no. 5, 1977 92 p
(JPRS-70135) Copyright. Avail: Issuing Activity

Articles concerning aerospace biology and medicine are presented. Topics discussed include metabolism, stresses, gravitation, visual and auditory perception during flight. For individual titles, see N78-18680 through N78-18696.

N78-18680# Joint Publications Research Service, Arlington, Va.
MAIN STAGES AND PROSPECTS OF DEVELOPMENT OF SPACE BIOLOGY AND MEDICINE
A. I. Burnazyan, Ye. I. Vorobyev, O. G. Gazenko, N. N. Gurovskiy, Yu. G. Nefedov, B. A. Adamovich, B. B. Yegorov, Ye. Ye. Kovalev, and A. D. Yegorov *In its* Space Biol. and Aerospace Med., No. 5, 1977 (JPRS-70135) 10 Nov. 1977 p 1-9 Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), no. 5, 1977 p 3-12 (For availability see N78-18679 09-52)
Copyright. Avail: Issuing Activity

Developments in space biology and medicine are reviewed in terms of preparation for manned space flight in the USSR. Life support systems for extravehicular activity, biological effects of artificial gravity, and radiation safety on long-term space flights are among the topics discussed. Application of technology developed during the space program to medical science is covered. J.M.S.

N78-18681# Joint Publications Research Service, Arlington, Va.
AVIATION MEDICINE ON THE SIXTIETH ANNIVERSARY OF THE GREAT OCTOBER REVOLUTION
N. M. Rudnyy *In its* Space Biol. and Aerospace Med., No. 5, 1977 (JPRS-70135) 10 Nov. 1977 p 10-17 Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), no. 5, 1977 p 12-18 (For availability see N78-18679 09-52)
Copyright. Avail: Issuing Activity

Aerospace medicine as it developed in the USSR is discussed. Medical support of flight personnel, the psychophysiological factors involved in flight training, and life support equipment are among the topics considered. The effects of high altitude, high pressure, weightlessness, acceleration, and vibration on man are included. J.M.S.

N78-18682# Joint Publications Research Service, Arlington, Va.
BIOMECHANICAL CRITERIA OF ARTIFICIAL GRAVITY
I. Yu. Sarkisov and A. A. Shipov *In its* Space Biol. and Aerospace Med., No. 5, 1977 (JPRS-70135) 10 Nov. 1977 p 18-27 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), no. 5, 1977 p 18-25 (For availability see N78-18679 09-52)
Copyright. Avail: Issuing Activity

The creation of artificial gravity in a rotating environment is considered in terms of the limitations imposed on the system by the physical and physiological effects on man. J.M.S.

N78-18683# Joint Publications Research Service, Arlington, Va.
CHANGE IN GRAVITATION LEVEL AS A STRESS FACTOR
L. V. Serova *In its* Space Biol. and Aerospace Med., No. 5, 1977 (JPRS-70135) 10 Nov. 1977 p 28-36 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), no. 5, 1977 p 25-32 (For availability see N78-18679 09-52)
Copyright. Avail: Issuing Activity

The results of experimental studies of the effects of weightlessness and hypergravitation on structural and functional characteristics of mammals are discussed. Emphasis is placed on growth and embryonic development and the extent of stress changes arising in the organism with prolonged and continuous exposure to altered gravitation conditions. J.M.S.

N78-18684# Joint Publications Research Service, Arlington, Va.
MAIN RESULTS OF MEDICAL RESEARCH CONDUCTED DURING THE FLIGHT OF TWO CREWS ON THE SALYUT-5 ORBITAL STATION
N. M. Rudnyy, O. G. Gazenko, S. A. Gozulov, I. D. Pestov, P. V. Vasilyev, A. V. Yeremin, V. A. Degtyarev, I. S. Balakhovskiy, R. M. Bayevskiy, and G. D. Syrykh *In its* Space Biol. and Aerospace Med., No. 5, 1977 (JPRS-70135) 10 Nov. 1977 p 37-46 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), no. 5, 1977 p 33-41 (For availability see N78-18679 09-52)
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The effect of weightlessness on man was studied on Salyut-5 orbital station. Test equipment included a space simulator for physical exercises, a weighted suit to be worn at all times, a vacuum container for the lower half of the body, a postflight preventive suit, and an onboard kit with a set of drugs. Telemetry methods as well as radio communications and television observations were used for routine medical monitoring of the cosmonauts. The physiological parameters were recorded and relayed over the telemetry communication channel by means of onboard equipment, both at rest and with measured loads. Results of the tests are discussed and tabulated. J.M.S

N78-18685# Joint Publications Research Service, Arlington, Va.
DISTINCTIONS OF FLUID AND ELECTROLYTE METABOLISM AND RENAL FUNCTION IN CREW MEMBERS OF THE FIRST SALYUT-4 EXPEDITION
A. I. Grigoryev, G. I. Kozyrevskaya, B. R. Dorokhova, V. I. Lebedev, and B. V. Morukov *In its* Space Biol. and Aerospace Med., No. 5, 1977 (JPRS-70135) 10 Nov. 1977 p 47-54 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), no. 5, 1977 p 41-47 (For availability see N78-18679 09-52)
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The fluid-electrolyte metabolism, osmoregulatory and ionoregulatory functions of the kidneys were examined before and after a 30 day orbital flight on the Salyut-4 station. Results indicate that the effect of weightlessness on kidney function is related to the duration of the space mission. J.M.S.

N78-18686# Joint Publications Research Service, Arlington, Va.
TECHNIQUE FOR SELECTIVE CATHETERIZATION OF THE HEART AND GREAT VESSELS USED IN BIOMEDICAL STUDIES OF HEALTHY INDIVIDUALS
O. G. Gazenko, V. I. Shumakov, Yu. M. Volynkin, B. I. Shalnev, L. I. Kakurin, V. M. Mikhaylov, V. Ye. Katkov, and V. V. Chestukhin

In its Space Biol. and Aerospace Med., No. 5, 1977 (JPRS-70135) 10 Nov. 1977 p 55-60 refs Transl. Into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), no. 5, 1977 p 47-51 (For availability see N78-18679 09-52)
Copyright. Avail: Issuing Activity

The benefits realized by applying selective catheterization of the brain, heart, liver, and kidney to the study of the effects of weightlessness are discussed. Factors considered include: monitoring metabolic changes not reflected in venous blood, monitoring pulmonary function, and monitoring changes in various parts of the cardiovascular system during space flight. J.M.S.

N78-18687# Joint Publications Research Service, Arlington, Va.

PARAMETERS OF ACID-BASE EQUILIBRIUM AND ENZYMATIC ACTIVITY OF BLOOD IN MAN DURING BRIEF ANTIORTHOSTATIC HYPOKINESIA

V. Ye. Katkov, N. I. Kaurichеva, V. V. Chestukhin, O. Kh. Zybin, R. D. Seyfulla, and V. N. Utkin *In its* Space Biol. and Aerospace Med., No. 5, 1977 (JPRS-70135) 10 Nov. 1977 p 61-69 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), no. 5, 1977 p 51-58 (For availability see N78-18679 09-52)
Copyright. Avail: Issuing Activity

The effect of brief antiorthostatic hypokinesia on parameters of acid-base equilibrium and aminotransferase and alkaline phosphatase activity in blood flowing from various organs was studied by performing selective catheterization before and after 5 days of bed rest in antiorthostatic position. A decrease in standard bicarbonate, excess of bases and buffer bases, as well as some drop of pH were noted. Results are discussed and are applicable to the study of the effects of weightlessness on brain metabolism. J.M.S.

N78-18688# Joint Publications Research Service, Arlington, Va.

MAIN OBJECTIVES AND RESULTS OF THE RADIOBIOLOGICAL EXPERIMENT CONDUCTED ON THE KOSMOS-690 BIOSATELLITE

Yu. G. Grigoryev, Yu. P. Druzhinin, V. V. Verigo, and Ye. A. Ilin *In its* Space Biol. and Aerospace Med., No. 5, 1977 (JPRS-70135) 10 Nov. 1977 p 70-79 Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), no. 5, 1977 p 58-66 (For availability see N78-18679 09-52)
Copyright. Avail: Issuing Activity

The biological effect of ionizing cosmic radiation and weightlessness were studied onboard the biosatellite Cosmos-690. Artificial sources of radiation were used to investigate the modifying effect of weightlessness on the radiobiological effect. Changes in radiosensitivity of animals and distinctions of formation of radiation lesions and characteristics of biological effects of heavy ions of galactic cosmic radiation on nervous tissue of mammals were emphasized. Results are compared with ground based control experiments. J.M.S.

N78-18689# Joint Publications Research Service, Arlington, Va.

LACTATE DEHYDROGENASE ISOZYMES OF RAT SKELETAL MUSCLES FOLLOWING A SPACE FLIGHT AND WITH HYPOKINESIA

N. V. Petrova and V. V. Portugalov *In its* Space Biol. and Aerospace Med., No. 5, 1977 (JPRS-70135) 19 Nov. 1977 p 80-87 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), no. 5, 1977 p 66-72 (For availability see N78-18679 09-52)
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The soleus and plantaris muscles of the hind limbs of male rats were studied to determine the influence of weightlessness and hypokinesia on carbohydrate metabolism. Changes in isozyme spectrum of the enzyme lactate dehydrogenase were measured. Results indicate that disturbances in carbohydrate metabolism resulting from hypokinesia lead to the development of atrophic and dystrophic changes in skeletal muscles. J.M.S.

N78-18690# Joint Publications Research Service, Arlington, Va.

MORPHOLOGICAL MANIFESTATIONS OF FUNCTIONAL CHANGES IN THE HYPOTHALAMO-HYPOPHYSEAL NEUROSECRETORY SYSTEM AND RAT KIDNEYS UNDER THE INFLUENCE OF SPACE FLIGHT FACTORS

Ye. A. Savina, A. S. Pankova, and Ye. I. Alekseyev *In its* Space Biol. and Aerospace Med., No. 5, 1977 (JPRS-70135) 10 Nov. 1977 p 88-93 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), no. 5, 1977 p 72-76 (For availability see N78-18679 09-52)
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The hypophyseal neurosecretory system and kidneys of rats that spent 22 days in flight on Cosmos-605 biosatellite were morphologically examined. Emphasis was placed on changes in hormone balance and fluid-electrolyte metabolism during space flight and upon return to earth, and diminished diuresis, decreased excretion of electrolytes and increased antidiuretic activity observed upon return to earth's gravity. J.M.S.

N78-18691# Joint Publications Research Service, Arlington, Va.

EFFECT OF HEAD ORIENTATION IN THE GRAVITY FIELD ON SEVERITY OF CALORIC NYSTAGMUS

V. N. Krutko, B. I. Polyakov, and M. I. Serebrennikov *In its* Space Biol. and Aerospace Med., No. 5, 1977 (JPRS-70135) 10 Nov. 1977 p 94-99 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), no. 5, 1977 p 76-80 (For availability see N78-18679 09-52)
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The intensity of vertical and horizontal caloric nystagmus was experimentally studied as a function of head orientation in a gravity field. Nystagmus was recorded as an electronstagmogram and vertical and horizontal eye movement recordings are compared. Results are presented. J.M.S.

N78-18692# Joint Publications Research Service, Arlington, Va.

A STUDY OF THE PULSED METHOD OF LAUNDERING

B. A. Adamovich, V. V. Borshchenko, Ya. N. Vernikov, A. G. Prishchep, and A. P. Rogatovskaya *In its* Space Biol. and Aerospace Med., No. 5, 1977 (JPRS-70135) 10 Nov. 1977 p 100-106 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), no. 5, 1977 p 80-85 (For availability see N78-18679 09-52)
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The design parameters of a washing and spinning device to be used for sanitary and housekeeping tasks on long-term manned space flight were experimentally studied. Results of these studies are presented. Temperature of the wash water and maximum removal of soil are correlated. J.M.S.

N78-18693# Joint Publications Research Service, Arlington, Va.

SIGNIFICANCE OF THE PERCUSSION SYMPTOM IN DETECTION OF PEPTIC ULCERS IN FLIGHT PERSONNEL

Ye. A. Fedorov and V. D. Vlasov *In its* Space Biol. and Aerospace Med., No. 5, 1977 (JPRS-70135) 10 Nov. 1977 p 107-110 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), no. 5, 1977 p 85-87 (For availability see N78-18679 09-52)
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The significance of local percussory tenderness and muscle tension during percussion with the index finger of the abdominal wall in diagnosis of a peptic ulcer was studied. The difference in incidence of markedly positive percussion symptoms in flight personnel with peptic ulcer at the stage of exacerbation or remission, as compared to the control group, is shown to be statistically reliable. J.M.S.

N78-18694# Joint Publications Research Service, Arlington, Va.

AUTOGENIC TRAINING USED FOR SELF-REGULATION OF CARDIOVASCULAR FUNCTION AND PREVENTION OF NEUROCIRCULATORY DYSTONIA IN PILOT CANDIDATES

V. S. Lozinskiy *In its* Space Biol. and Aerospace Med., No. 5, 1977 (JPRS-70135) 10 Nov. 1977 p 111-115 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), no. 5, 1977 p 88-90 (For availability see N78-18679 09-52)
Copyright. Avail: Issuing Activity

The use of autogenic training to control arterial pressure

and pulse rate was investigated in pilot candidates. Results indicate that there was stable normalization of the arterial pressure, but no decrease of pulse rate. F.O.S.

N78-18695# Joint Publications Research Service, Arlington, Va.

INVESTIGATION OF SPACE PERCEPTION BY THE CREW OF THE EXPERIMENTAL SOYUZ-APOLLO MISSION

L. N. Kornilova, G. D. Syrykh, I. K. Tarasov, and I. Ya. Yakovleva *In its* Space Biol. and Aerospace Med., No. 5, 1977 (JPRS-70135) 10 Nov. 1977 p 116-117 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), no. 5, 1977 p 90-91 (For availability see N78-18679 09-52)

Copyright. Avail: Issuing Activity

The perception of spatial coordinates was studied to obtain objective, quantitative information about perception before and after space flights. The correlation between indices of accuracy and the intensity of subjective reactions were investigated. Author

N78-18696# Joint Publications Research Service, Arlington, Va.

EFFECTS OF HIGH CONCENTRATIONS OF CARBON DIOXIDE ON FUNCTION OF THE HUMAN ACOUSTIC ANALYZER

Yu. V. Krylov *In its* Space Biol. and Aerospace Med., No. 5, 1977 (JPRS-70135) 10 Nov. 1977 p 118-120 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), no. 5, 1977 p 91-92 (For availability see N78-18679 09-52)

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The distinctions of the human acoustic analyzer in the presence of a high concentration of carbon dioxide in inhaled air (from 1 to 8%) were analyzed. The thresholds of auditory sensibility for airborne conduction were tested at frequencies of 125-10,000 Hz on 15 healthy males ranging in age from 19 to 30 years. Audiometry was performed before, during and 5-30 min after the experiment. It was shown that exposure of man to an atmosphere with CO2 concentration of 1 to 2% for many days does not lead to a statistically reliable change in hearing thresholds. The same findings were obtained with exposure of man to an atmosphere with up to 3% CO2. The first changes in auditory thresholds were obtained when the subjects were exposed for a long period of time to a respiratory gas mixture with 4 to 4.5% CO2. Author

N78-18697 Indiana Univ., Bloomington.

PACEMAKER RELATED CONDUCTANCE CHANGES IN CARDIAC PURKINJE FIBERS Ph.D. Thesis

Joseph Reiser 1977 214 p

Avail: Univ. Microfilms Order No. 77-30314

The relationship of input resistance (Rin), during spontaneous diastolic depolarization, to the steady steady state current-voltage profile (V/Iss) in cardiac Purkinje fibers was studied. Values of Rin during diastolic deplorization ranged from 1.26 x .17 x 10 to the 5th power Omega at the most negative potential to 2.35 + or - .22 x 10 to the 5th power Omega at the most positive. Variations in slope conductance obtained from V/Iss over a similar voltage excursion, ranged from 1.21 + or - .25 x 10 to the 5th power Omega to 2.28 + or - .13 x 10 to the 5th power Omega. Results suggest that changes in membrane conductance occurring in spontaneous Purkinje fibers may not be the primary mechanism involved in initiation of spontaneous diastolic depolarization. Dissert. Abstr.

N78-18698 Duke Univ., Durham, N. C.

NERVE FORM AND FUNCTION: SOME CELLULAR ASPECTS OF ACTION POTENTIAL INITIATION AND PROPAGATION Ph.D. Thesis

Richard Mont Westerfield, Jr. 1977 175 p

Avail: Univ. Microfilms Order No. 77-31704

A method was developed to separate clearly the effects of geometry from the effects of membrane properties on the initiation and propagation of impulses in nerve cells. The electrical properties of squid giant axons with regional inhomogeneities were studied. Inhomogeneities were induced by lowering the internal resistance with an axial wire, by shifting the voltage dependence of the membrane conductances with lanthanum and by decreasing the current density with tetrodotoxin. Many of the experiments were simulated with a computer model of the axon and the electrodes. Dissert. Abstr.

N78-18699*# National Aeronautics and Space Administration, Washington, D. C.

CERTAIN PECULIARITIES OF THE FUNCTIONING OF THE CARDIOVASCULAR SYSTEM IN BEDREST CONDITIONS DURING HORIZONTAL AND ANTIORTHOSTATIC BODY POSITIONS

Jan. 1978 27 p refs Transl. into ENGLISH of "Nekotoryye osobesnnosti funktsion irovaniya serdechno-sosydistoy sistemy v usloviyak postel'nogo rezhima pri gorizontal nom i antiortostatic-heskom polozheniyakh tela" Acad. Sci. USSR, Moscow, 1977 p 1-33 Transl. by Scientific Translation Service, Santa Barbara, Calif. Orig. Doc. prep. by Academy of Sciences USSR, Moscow

(Contract NASw-2791)

(NASA-TM-75075) Avail: NTIS HC A03/MF A01 CSCL 06S

The adequate modeling of physiological reactions inherent to the state of weightlessness has become a matter of particular urgency in space medicine. This modeling is necessary for studying the phenomenology and degree of disorders, prognostication of the crew's health, and developing the various preventive measures employed in space flights. A comparison is made of the physiological effects brought about by bed rest in a horizontal and antiorthostatic body position. A study is done of the influence of brief antiorthostatic hypokinesia, simulating the acute period of adaptation to weightlessness, on circulation and on a number of involved analytical systems. The basic model accepted is antiorthostatic hypokinesia with a body position declination angle of 4 deg (head lower than feet). The experiment's duration is dictated by the objectives of the research. Author

N78-18700*# Michigan Univ., Ann Arbor. Kresge Hearing Research Inst.

EVALUATION OF POSTURAL MECHANISMS UNDER DYNAMIC CONDITIONS Final Report, First Year

David J. Anderson Jan. 1978 25 p

(Contract NAS9-15244)

(NASA-CR-151638) Avail: NTIS HC A02/MF A01 CSCL 06P

A stimulus delivery and data acquisition system for assessment of human posture was developed based on a digital computer and a translating platform. The movement of the platform acts to displace the subject's base of support while the computer tracks the corrections which are made by the subject to maintain balance. Various stimuli are used ranging from fast transients to sine waves. Author

N78-18701*# Iowa Univ., Iowa City. Cardiovascular and Clinical Research Centers.

INFLUENCE OF LOW AND HIGH PRESSURE BARORECEPTORS ON PLASMA RENIN ACTIVITY IN HUMANS

Allyn L. Mark, Francois M. Abboud, and Annette E. Fitz [1977] 27 p refs

(Grants NsG-9060; MIRS-5462; HL-14388; HL-16149; RR-59)

(NASA-CR-155307) Avail: NTIS HC A03/MF A01 CSCL 06P

The effects of low and high pressure baroreceptors on plasma renin activity (immunoassay) were evaluated using graded lower body suction (LBS) in six healthy men. LBS at -10 and -20 mmHg for 10 min decreased central venous pressure without changing arterial pressure and thereby presumably reduced low but not high pressure baroreceptor inhibition of renin release. LBS at these levels produced forearm vasoconstriction, but did not increase renin. LBS at -40 mmHG decreased central venous and arterial pulse pressure and thus reduced both low and high pressure baroreceptor inhibition. LBS at this level produced forearm vasoconstriction and tachycardia and increased renin. In summary, reduction in low pressure baroreceptor inhibition in humans did not increase renin in the presence of physiological tonic inhibition from high pressure baroreceptors. Increases in renin did not occur until there was combined reduction of high and low pressure baroreceptor inhibition on plasma renin activity. Author

N78-18702*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SYNTHESIS AND BIOLOGICAL SCREENING OF NOVEL HYBRID FLUOROCARBON HYDROCARBON COMPOUNDS FOR USE AS ARTIFICIAL BLOOD SUBSTITUTES Annual Report, Jul. 1976 - Jul. 1977
J. Moacanin, K. Scherer, A. Toronto, D. Lawson, T. Terranova, L. Astle, and S. Harvey 3 Mar. 1978 198 p refs Sponsored in part by Natl. Heart, Lung and Blood Inst.
(Contracts NAS7-100)
(NASA-CR-155781; JPL-Pub-77-80) Avail: NTIS HC A09/MF A01 CSCL 06A

The goal of this project is to prepare a series of hybrid fluorochemicals of general structure R1R2R3CR4, where the Ri's are saturated fluoroalkyl groups of formula CnF2n+1' and R4 is an alkyl group CnH2n+1 or related moiety containing amino, ether or ester functions but no C-F bonds. Results of the initial year's work include: (1) successful syntheses of several candidate compounds with acceptable physical properties; (2) preliminary toxocity results indicating that at least one of these is non-toxic, contrary to the previous belief that significant hydrogen content necessitates toxicity; and (3) the development of a method for predicting vapor pressure and oxygen solubility from chemical structure alone, to guide the synthetic efforts in the most fruitful direction. Author

N78-18703# Texas Univ., Austin.
SLEEP WAKEFULNESS DETERMINATIONS FROM HEART RATE DATA, VOLUME 3 Annual Report, 1 Jun. 1976 - 15 Mar. 1977
P. C. Richardson, A. J. Welch, T. P. Daubek, and L. E. Taylor 31 May 1977 112 p refs
(Contract DAMD17-74-C-4081)
(AD-A045817) Avail: NTIS HC A06/MF A01 CSCL 06/16

During the past years several projects have been conducted at the University of Texas at Austin by members of the Bio-Medical Engineering Program investigating the automated classification of levels of wakefulness. The primary design and goal of these projects was rapid, inexpensive determination of levels of wakefulness performed accurately using easily derived physiologic parameters. It was felt that by combining some of the procedures and results of previous studies with the procedures developed from the last two years of this research, a conglomerate algorithm which had the capabilities desired could be developed. During the third year of this research, an altered algorithm has been developed from previous algorithms to classify REM(+) - NREM sleep stages from minute-by-minute heart rate. The reclassification of the two training nights yielded accuracies of 51.30% and 63.68% for night one of LES and night one of FER, respectively. Accuracies from the remaining data of subject LES yielded 60.11% to 66.50%, of subject FER 45.99% to 63.68%. Subject OWN, whose data were not used in any training, yielded accuracies from 52.27% to 58.60%. GRA

N78-18704# Air Force Human Resources Lab., Brooks AFB, Tex.
AUDIO-VISUAL PROFICIENCY TESTING: ANNOTATED BIBLIOGRAPHY Interim Report, Oct. 1976 - Jun. 1977
Dale J. Wissman Oct. 1977 17 p refs
(AD-A048122; AFHRL-TR-77-54) Avail: NTIS HC A02/MF A01 CSCL 05/9

This report contains an annotation of published reports dealing with the use of audio-visual media for proficiency testing. Reports included discuss investigation of audio-visual administrations of standardized printed tests as well as motion picture filmed tests assessing job knowledge and skill. Reports dealing with the use of audio-visual media in teaching were not included, though references to several bibliographies dealing with the use of motion pictures in education are listed. The majority of the investigations of motion picture filmed tests were done between 1945 and 1958. Most of the more recent research is limited to the audio-visual display of printed tests during test administration. Although the published results of the reviewed reports vary from extremely positive to quite negative, the general finding of this review stresses the paucity of thorough investigations using the audio-visual medium in proficiency testing. GRA

N78-18705# Franklin Inst. Research Labs., Philadelphia, Pa.
BIOLOGICAL EFFECTS OF NONIONIZING ELECTROMAGNETIC RADIATION VOLUME 2: NUMBER 2, DECEMBER 1977 Quarterly Report, Sep. - Dec. 1977
Bruce H. Kleinstein and Elena P. Saboe Dec. 1977 41 p
(Contract TP-7AC024)
(AD-A047647; FIRL-C-4735-01-Vol-2; TP-7AC024) Avail: NTIS HC A03/MF A01 CSCL 06/18

This quarterly digest presents current awareness information on the biological effects of nonionizing electromagnetic radiation (microwave and radiofrequency) in the range of 0 Hz to 100 GHz. The effects of magnetic and electric fields (static and alternating) are also covered. Each issue contains abstracts of English and foreign current literature, summaries of ongoing research investigations, news items, and a directory of meetings and conferences. Author (GRA)

N78-18706# Istituto Superiore di Sanita, Rome (Italy). Lab. di Fisica.
TECHNICAL AND SCIENTIFIC ASPECTS OF SANITARY AND SAFETY PROBLEMS IN NUCLEAR ENERGY PRODUCTION
G. CamposVenuti, S. Frullani, L. Maiani, S. Risica, A. Rogani, and E. Tabet 3 Jun. 1976 83 p refs In ITALIAN; ENGLISH summary Presented at the Soc. Ital. di Fis. Conf. 'Problemi Sanit. e di Sicurezza Connessi con l'Energia Elettronucl.', Bologna, 23-24 Apr. 1976 Submitted for publication
(ISS-P-76/9) Avail: NTIS HC A05/MF A01

Some safety and health problems of the nuclear fuel cycle are discussed. Attention is given essentially to topics related to reprocessing plants and to reactor safety. A critical examination of some items in the radiological protection methodology is presented together with a possible scheme for the selection of nuclear sites. Author (ESA)

N78-18707# Technische Hogeschool Twente, Enschede (Netherlands). Afdel. der Elektrotechniek.
DESIGN OF A PYRO-ELECTRIC VIDICON CAMERA FOR MEDICAL THERMOGRAPHY Final Report
G. S. Hoeksma 11 May 1977 105 p refs
(THT-TM-77-009) Avail: NTIS HC A06/MF A01

The technical feasibility and design parameters of a pyroelectric vidicon (PEV) camera for medical purposes were surveyed. It was found that synchronous chopping is the best operating method for a PEV camera. A 25 Hz chopper frequency yields the best spatial resolution using standard TV readout (50 Hz raster frequency). Camera MTF is then determined mainly by thermal diffusivity in the PEV target which is about equal for current tube types. Important errors are introduced in the signal by pedestal non-uniformities, which can be processed out but degrade picture quality heavily. A method to remedy the disturbances is proposed. Conclusions of the experimental work are that it is advisable to bring part of the video circuits out of the camera to prevent parasitic oscillations due to the high gain needed and that ion pedestal generation during forward scan is not very well suited for the synchronous chopper mode. ESA

N78-18708# European Space Agency, Paris (France).
THE INFLUENCE OF THE JOURNEY'S TIME OF DAY ON THE DE- AND RESYNCHRONIZATION OF THE 24-HOUR RHYTHM OF BODY AND TEMPERATURE AFTER TRANSATLANTIC FLIGHTS
Arnold Theodor Sonderfeld Jan. 1978 60 p refs Transl. into ENGLISH of 'Der Einfluss der Tageszeit der Reise auf die De- u. Resynchronisation der Tagesrhythmik der Koerpertemp. nach Transatlantikfluegen', DFVLR, Bonn Report DLR-FB-77-10, 24 Mar. 1977 Original report in GERMAN previously announced as N77-30740 Original German report available from DFVLR, Cologne DM 22,80
(ESA-TT-420; DLR-FB-77-10) Avail: NTIS HC A04/MF A01

The influence of a time-shift of 6 hrs on the 24-hr rhythm of body temperature was investigated in a group of eight students in Germany and the U.S. by measuring their rectal temperatures after transatlantic flights. The temperatures were taken continuously over the first 6 days and on days 8 and 13 after an east-west flight and after a west-east flight. In contrast to previous studies in which the west flight was a day flight, the east flight a night flight, both flights in this case were day flights. The time of resynchronisation after the east-west flight ran up to 7 days, the time after a flight in the opposite direction up to 10

days. This result squares with the results gained from previous experiments on day and night flights insofar as an influence of the hour of the day at which the flight is carried out is not supposed. Author (ESA)

N78-18709# Interuniversitair Reactor Instituut, Delft (Netherlands).
PATIENT DOSES RESULTING FROM AN X-RAY RECORDING (BELLY SURVEY PICTURE). INFLUENCE OF TECHNICAL PARAMETERS ON THE DOSAGE [PATIENTDOSIS TENGEVOLGE VAN EEN ROENTGENOPNAME (BUIKVERZICHTSFOTO). INVLOED VAN TECHNISCHE PARAMETERS OP DE DOSIS]
A. VantRiet Sep. 1977 80 p refs In DUTCH
(IRI-190-77-01) Avail: NTIS HC A05/MF A01

The influence of technical parameters on the patient dosage in X-ray diagnostics was investigated. In 46 Dutch hospitals for 650 adult female patients skin exposure measurements were made during the recording of the belly photograph as part of the intravenous pyelography investigation from March 1976 to 1977. The halve thickness of the radiation was also determined and in 15 hospitals measurements on a Rando phantom were made. Results show an appreciable spread in the entrance and exit exposure; however, it is shown that it is possible, in daily X-ray diagnosis, to index relatively high exposures for the belly survey picture. Some possibilities for reducing the dosage are indicated. ESA

N78-18710# Office of Radiation Programs, Washington, D. C.
RADIOLOGICAL QUALITY OF THE ENVIRONMENT IN THE UNITED STATES, 1977 Final Report
Kurt L. Feldman Sep. 1977 307 p refs
(PB-274229/4; EPA-520/1-77-009) Avail: NTIS HC A14/MF A01 CSCL 06R

The report is part of Office of Radiation Programs (ORP's) dose assessment program for evaluating the radiological quality of the environment. Special emphasis was placed on acquiring and summarizing the most recent dose data available. For some source categories, dose information was available for calendar year 1976, for others the most recent data go back to the early 1970's. The concern was for the availability of data and what the existing data provided for individual and population dose information. However, gaps in data coverage and areas of inadequate data coverage are identified when found. Author

N78-18711# Georgia Inst. of Tech., Atlanta. Electromagnetic Effectiveness Div.
RF DIELECTRIC PROPERTIES MEASUREMENT SYSTEM: HUMAN AND ANIMAL DATA
J. Toler and J. Seals Jul. 1977 89 p refs
(Contract PHS-CDC-210-76-0136)
(PB-274776/4; DHEW/PUB/NIOSH-77/176) Avail: NTIS HC A05/MF A01 CSCL 06R

Research efforts are described that led to the development of an instrumentation system for accurately measuring relative dielectric constant and conductivity of materials used in phantom modeling research, over a 10 to 100 MHz range. The system is based on an antenna modeling theorem which relates the impedance of a short monopole antenna in air to its impedance in dielectric media with a high radiofrequency power absorption such as phantom modeling materials and biological tissues. Accuracy and repeatability of the system were demonstrated by comparing measured electrical property data with corresponding reference data published in the literature. GRA

N78-18712# Washington Univ., Seattle. Bioelectromagnetics Research Lab.
RF CELL CULTURE IRRADIATION SYSTEM WITH CONTROLLED TEMPERATURE AND FIELD STRENGTH
Arthur W. Guy Jun. 1977 55 p refs Prepared for School of Aerospace Med.
(Contract NIOSH-IA-75-30)
(PB-274793/9; DHEW/PUB/NIOSH-77/182) Avail: NTIS HC A04/MF A01 CSCL 06R

The system produced electric field strengths up to 100 V/cm from D.C. to 1000 MHz in a 5 ml sample of culture medium. The culture medium temperature was controlled and measured up to 100 MHz by monitoring the feedline impedance, which was dependent on culture medium temperature. Constant temperatures below 37C can be maintained at field strengths in excess of 25 V/cm. The information that was obtained with the use of this system was needed to fill information gaps for standards criteria development. GRA

N78-18713# National Academy of Sciences - National Research Council, Washington, D. C. Committee on Medical and Biologic Effects of Environmental Pollutants.
CARBON MONOXIDE
Sep. 1977 354 p refs
(Contract EPA-68-02-1226)
(PB-274965/3; EPA-600/1-77-034) Avail: NTIS HC A16/MF A01 CSCL 06T

Carbon monoxide literature related to effects on man and his environment is summarized. Recent major advances in our knowledge of carbon monoxide are emphasized, including chemical reactions in air; biologic effects on man; problems in monitoring urban concentrations and relating such data to the exposure of populations; data concerning the identification of susceptible populations; and evidence implicating carbon monoxide as a causal factor of disease. GRA

N78-18714# National Bureau of Standards, Boulder, Colo. Electromagnetics Div.
MEASUREMENT OF RF POWER-ABSORPTION IN BIOLOGICAL SPECIMENS, 10 TO 100 MHz
Frank M. Greene Feb. 1977 31 p refs
(Contract NIOSH-IA-75-16)
(PB-274218/7; DHEW/PUB/NIOSH-77/146) Avail: NTIS HC A03/MF A01 CSCL 06R

This method was based on measuring the forward and reflected power on the transmission line feeding the synthesizer. Commercially available rf wattmeters were used, and an automatic data acquisition system employed 'read' the meters and rapidly calculated, displayed, and recorded the rf power flow. The advantage was that the exact measuring point on the feed line was not critical, as it was with methods employing direct impedance measurements, and that the required measurements were made without interfering with the exposure tests. GRA

N78-18715# Joint Publications Research Service, Arlington, Va.
SPACE BIOLOGY AND AEROSPACE MEDICINE, NO. 3, 1977
7 Jul. 1977 139 p refs Transl. into ENGLISH from Kosm. Biol. Aviakosmich. Med. (USSR), no. 3, 1977 p 1-87
(JPRS-69380) Avail: NTIS HC A07/MF A01

Articles are presented concerning the selection and training of cosmonauts; evaluation and analysis of accumulated data to facilitate the on-going transition from orbital to interplanetary flights; research aimed at guaranteeing safety on long flights and reliability of the human component of the 'man-spaceship' system; space psychology and physiology; environmental problems and control and telemetry. For individual titles, see N78-18716 through N78-18737.

N78-18716# Joint Publications Research Service, Arlington, Va.
PSYCHOPHARMACOLOGY IN AVIATION AND ASTRONAUTICS
P. V. Vasilyev and G. D. Glod *In its* Space Biol. and Aerospace Med., No. 3, 1977 (JPRS-69380) 7 Jul. 1977 p 1-14 Transl. into ENGLISH from Kosm. Biol. Aviakosmich. Med. (USSR), no. 3, 1977 p 3-11 (For availability see N78-18715 09-52) Avail: NTIS HC A07/MF A01

Pharmacological agents with psychotropic action were investigated as a means of maintaining a high degree of efficiency and professional reliability in spacecrews. Theoretical and applied aspects of using psychopharmacological agents (PPA) in aerospace medicine were each considered. The pathogenesis of impaired efficiency of pilots and astronauts in flight and the capabilities of current PPA, provide grounds for two basic directions of PPA application at the present time: for the prevention or correction of functional disturbances in the central nervous system that are related to fatigue, and for controlled regulation of emotions. Author

N78-18717# Joint Publications Research Service, Arlington, Va.

EXPERIMENTAL AND GENERAL THEORETICAL RESEARCH

O. G. Gazenko, A. A. Prokhochukov, V. V. Panikarovskiy, R. A. Tigranya, A. G. Kolesnik, G. N. Pakhomov, A. S. Grigoryan, Z. P. Antipova, S. M. Remezov, and N. A. Komissarova *In its* Space Biol. and Aerospace Med., No. 3, 1977 (JPRS-69380) 7 Jul. 1977 p 15-24 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmich. Med. (USSR), no. 3, 1977 p 11-20 (For availability see N78-18715 09-52)

Avail: NTIS HC A07/MF A01

The influences of space flight factors on calcium metabolism were investigated since elevation of blood calcium, increased excretion of calcium in urine and feces, and decreased mineralization of some skeletal bones have been observed in astronauts after prolonged space flight. Tissue of different skeletal bones were comprehensively investigated using autopsy material from the crew of Salyut-1. Pathohistological, crystallographic, biophysical, and biochemical techniques were used during an in-depth examination of the material. Author

N78-18718# Joint Publications Research Service, Arlington, Va.

DISTINCTIVE FEATURES OF REGIONAL CIRCULATION AND VASOMOTOR REGULATION FOLLOWING A TWO-MONTH SPACE FLIGHT

Kh. Kh. Yarullin and T. D. Vasilyeva *In its* Space Biol. and Aerospace Med., No. 3, 1977 (JPRS-69380) 7 Jul. 1977 p 25-32 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmich. Med. (USSR), no. 3, 1977 p 20-26 (For availability see N78-18715 09-52)

Avail: NTIS HC A07/MF A01

Vasomotor regulation and regional hemodynamics of astronauts during and after space flights were studied in view of the significant redistribution of blood in the body under the influence of weightlessness. Rheoencephalograms in the frontomastoidal and bimastoidal leads, as well as rheograms of the right lung and crus, photoplethysmogram of the third finger and EKG in the second standard lead were recorded synchronously for the crews of Soyuz-18 and Salyut-4 after extended time in space. Marked changes in regional hemodynamics were detected from these rheographic studies. Author

N78-18719# Joint Publications Research Service, Arlington, Va.

STUDIES OF CIRCULATION DURING LBNP TEST ABOARD SALYUT-4 ORBITAL STATIONS

V. A. Degtyarev, V. G. Doroshev, T. V. Batenchuk-Tusko, Z. A. Kirillova, N. A. Lapshina, S. I. Ponamarev, and V. N. Ragozin *In its* Space Biol. and Aerospace Med., No. 3, 1977 (JPRS-69380) 7 Jul. 1977 p 33-38 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmich. Med. (USSR), no. 3, 1977 p 26-31 (For availability see N78-18715 09-52)

Avail: NTIS HC A07/MF A01

The functional test utilizing lower body negative pressure was used on the Salyut-4 orbital station as part of cosmonaut medical monitoring. This test was confirmed during preflight preparations as informative for the prediction and evaluation of orthostatic endurance. The tachyoscillogram and distal perimetric oscillogram of the brachial artery, kinetocardiogram in the region of the apex beat and sphygmogram of the femoral artery were recorded. Results show that heart rate increased by 30 to 36%, minute volume decreased by 20 to 37% and stroke volume by 33 to 45%. Diastolic arterial pressure rose by a maximum of 14 to 18% while pulse pressure rose by 20 to 26%. Author

N78-18720# Joint Publications Research Service, Arlington, Va.

DYNAMICS OF ORTHOSTATIC STABILITY OF COSMONAUTS FOLLOWING 2 TO 63 DAY MISSIONS

V. V. Kalinichenko *In its* Space Biol. and Aerospace Med., No. 3, 1977 (JPRS-69380) 7 Jul. 1977 p 39-45 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmich. Med. (USSR), no. 3, 1977 p 31-37 (For availability see N78-18715 09-52)

Avail: NTIS HC A07/MF A01

Orthostatic stability of Soyuz spacecraft crew members was studied, since it is known that cosmonauts experience difficulties in readaptation to earth's gravitation chiefly due to deconditioning of the circulatory system. Indices calculated, include heart rate per minute, left ventricular expulsion time, arterial pressure, end systolic pressure, mean dynamic pressure, diastolic pressure, arm/leg lateral systolic pressure, pulse wave velocity and stroke. The integral index of orthostatic stability was calculated from mean values of the aforementioned indices. Author

N78-18721# Joint Publications Research Service, Arlington, Va.

SOME PSYCHONEUROLOGICAL REQUIREMENTS IN ASSESSING INFLIGHT FUNCTIONAL STATE OF COSMONAUTS

V. I. Myasnikov, O. V. Konkova, and F. N. Uskov *In its* Space Biol. and Aerospace Med., No. 3, 1977 (JPRS-69380) 7 Jul. 1977 p 46-49 ref Transl. into ENGLISH from Kosm. Biol. Aviakosmich. Med. (USSR), no. 3, 1977 p 37-39 (For availability see N78-18715 09-52)

Avail: NTIS HC A07/MF A01

Word tests were developed to demonstrate the distinctive features of similarity assessment on the basis of incomplete information. Tests consisted of a series of synonyms, and were utilized as aids to the neuropsychiatrist in his evaluation of the current state of cosmonauts. Results were used to calculate the index of stability of judgment based on the number of times a given subject changed his mind. Author

N78-18722# Joint Publications Research Service, Arlington, Va.

HISTOCHEMICAL STUDY OF DIGESTIVE ORGANS OF RATS FOLLOWING FLIGHT ON KOSMOS-605

M. G. Shubich, L. L. Goryacheva, V. I. Dudetskiy, N. M. Lutsenko, and G. M. Mogilnaya *In its* Space Biol. and Aerospace Med., No. 3, 1977 (JPRS-69380) 7 Jul. 1977 p 50-55 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmich. Med. (USSR), no. 3, 1977 p 40-46 (For availability see N78-18715 09-52)

Avail: NTIS HC A07/MF A01

A comparative study was made of the stomach, small and large intestine, and pancreas of rats that had spent 22.5 days onboard Kosmos-605 satellite. Rats from a ground-based model experiment and intact rats maintained on the same diet in a vivarium were also examined. Results are discussed. Author

N78-18723# Joint Publications Research Service, Arlington, Va.

MUCOPOLYSACCHARIDES AND COLLAGEN OF TISSUES IN HYPOKINETIC RATS

P. P. Potapov *In its* Space Biol. and Aerospace Med., No. 3, 1977 (JPRS-69380) 7 Jul. 1977 p 56-61 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmich. Med. (USSR), no. 3, 1977 p 44-48 (For availability see N78-18715 09-52)

Avail: NTIS HC A07/MF A01

Hypokinetic rats were used to investigate changes demonstrated in fluid-electrolyte metabolism of cosmonauts in weightlessness and in subjects kept on strict bed rest. Content levels of collagens and mucopolysaccharides in animal tissue were studied at different stages of hypokinesia and in the recovery period. Blood serum, tissues of the liver, heart, kidneys, brain and skeletal muscles from the posterior group of the thigh served as the material to be studied. Results indicate restricted mobility led to a significant increase in hydroxyproline content of skeletal muscle. Author

N78-18724# Joint Publications Research Service, Arlington, Va.

CARDIOVASCULAR REACTIONS TO ORTHOSTATIC TESTS AND HUMAN RESISTANCE TO VESTIBULAR STIMULI

B. I. Polyakov, B. Ye. Petrenko, A. B. Savvin, I. G. Tazetdinov, and A. M. Tarko *In its* Space Biol. and Aerospace Med., No. 3, 1977 (JPRS-69380) 7 Jul. 1977 p 62-67 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmich. Med. (USSR), no. 3, 1977 p 48-52 (For availability see N78-18715 09-52)

Avail: NTIS HC A07/MF A01

The correlation between the level of vestibular stability (LVS) and nature of transient processes in the cardiovascular system during passive orthostatic testing (OTP) was studied, as well as the analogous correlation to the active orthostatic test, in an attempt to better understand motion sickness. Mathematical

analysis was employed to test multiple correlation between different groups of parameters from the initial set for OTP and LVS, to single out groups of parameters that would yield the maximum confidence coefficient of difference. A special program was prepared to express the method of gradient decline in the space of groups of parameters. Equations of linear multiple regression were devised to express the link between LVS and parameters contained in the group. Author

N78-18725# Joint Publications Research Service, Arlington, Va.

DYNAMIC CONTROL OF PARAMETERS OF SPACECRAFT ATMOSPHERE

I. S. Breslav and V. N. Salazkin *In its* Space Biol. and Aerospace Med., No. 3, 1977 (JPRS-69380) 7 Jul. 1977 p 68-75 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmich. Med. (USSR), no. 3, 1977 p 68-75 (For availability see N78-18715 09-52)

Avail: NTIS HC A07/MF A01

Nonstationary atmospheres in spacecraft were proposed in light of long duration space flights and the range of work performed by cosmonauts. A 'rapid' control of environment parameters was considered as an approach to the problem. This approach was based on operational monitoring of body functions with the objective of providing a high level of cosmonaut efficiency with different load levels and counteracting disturbances of physiological conditions in the case of abrupt changes in state and conditions of vital functions. The patterns of control of partial pressures of oxygen and carbon dioxide in the spacecraft atmosphere were determined. Author

N78-18726# Joint Publications Research Service, Arlington, Va.

MECHANICS OF SPEECH-RELATED RESPIRATION WHILE PERFORMING STATIC PHYSICAL EXERCISE

M. A. Tikhonov and A. S. Belan *In its* Space Biol. and Aerospace Med., No. 3, 1977 (JPRS-69380) 7 Jul. 1977 p 76-82 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmich. Med. (USSR), no. 3, 1977 p 58-63 (For availability see N78-18715 09-52)

Avail: NTIS HC A07/MF A01

The biomechanical aspects of speech formation, specifically the correlation between speech and mechanical and aerodynamic processes in the lungs and vocal tract, were comprehensively investigated. Studies of respiration mechanics were made while subjects performed physical exercise. Volumetric air flow velocity and the integrated curve of respiratory volumes were recorded. Transpulmonary intrathoracic pressure was measured in the middle third of the esophagus. Results of quantitative analysis of volume and rate indices of pulmonary ventilation during ordinary breathing and speech associated with a progressively increasing physical load are given in tabular form. Author

N78-18727# Joint Publications Research Service, Arlington, Va.

ELECTROLYTE CONTENT OF BLOOD AND POTASSIUM ION TRANSPORT IN ERYTHROCYTES OF ANIMALS EXPOSED TO A STEADY MAGNETIC FIELD

G. K. Gerasimova and Z. N. Nakhilnitskaya *In its* Space Biol. and Aerospace Med., No. 3, 1977 (JPRS-69380) 7 Jul. 1977 p 83-24 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmich. Med. (USSR), no. 3, 1977 p 63-67 (For availability see N78-18715 09-52)

Avail: NTIS HC A07/MF A01

The nature and extent of steady magnetic field influence on concentration of potassium and sodium ions in blood was shown. Distribution thereof in plasma and erythrocytes, blood pH and erythrocyte volume in animal blood, as well as transfer of potassium ions through the erythrocyte membrane in in vitro experiments was determined. Author

N78-18728# Joint Publications Research Service, Arlington, Va.

HEMOPOIESIS IN DOGS EXPOSED TO LETHAL DOSES OF PROTONS WITH SHIELDED BONE MARROW

G. F. Nevskaya, G. M. Abramova, Ye. V. Ginsburg, D. N. Ishmukhametova, and A. S. Skorik *In its* Space Biol. and Aerospace Med., No. 3, 1977 (JPRS-69380) 7 Jul. 1977 p 88-92 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmich. Med. (USSR), no. 3, 1977 p 67-70 (For availability see N78-18715 09-52)

Avail: NTIS HC A07/MF A01

The long term effects of nonuniform irradiation by protons were investigated, in order to assure radiation safety of space missions. Studies were referable to the results of 6 year observation of 18 dogs exposed twice to minimum absolutely lethal doses (350 rad) of protons at a 45 day interval. Author

N78-18729# Joint Publications Research Service, Arlington, Va.

INVESTIGATION OF CONCOMITANT MICROFLORA IN PROLONGED SUBSTRATE-FREE CULTIVATION OF BEET PLANTS

L. S. Yunusova and N. A. Drugova *In its* Space Biol. and Aerospace Med., No. 3, 1977 (JPRS-69380) 7 Jul. 1977 p 93-96 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmich. Med. (USSR), no. 3, 1977 p 71-74 (For availability see N78-18715 09-52)

Avail: NTIS HC A07/MF A01

The dynamics of microorganism population size in the case of long-term substrate-free cultivation of beet plants, as well as their qualitative and quantitative composition, were investigated. The dominant forms of microorganisms isolated in the course of prolonged cultivation of beets were also identified. Author

N78-18730# Joint Publications Research Service, Arlington, Va.

PHYSIOLOGY OF ANTIORTHOSTATISM

K. L. Geykhman and M. R. Mogendovich *In its* Space Biol. and Aerospace Med., No. 3, 1977 (JPRS-69380) 7 Jul. 1977 p 97-101 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmich. Med. (USSR), no. 3, 1977 p 75-76 (For availability see N78-18715 09-52)

Avail: NTIS HC A07/MF A01

The physiology of antiorthostatics was investigated, and accelerations and weightlessness in man were simulated. The concept of antiorthostatism was introduced and a distinction between passive and active antiorthostatics was made. The distinctions of kinesthesia, changes in skin and internal temperature, oxygenation of blood and sensibility of the acoustic analyzer were investigated. The question of using antiorthostatic experiment data for the screening of cosmonauts and development of preventive measures was also studied. Author

N78-18731# Joint Publications Research Service, Arlington, Va.

HETEROPHILIC ANTIBODIES AND COMPLEMENT ACTIVITY OF RAT BLOOD SERUM AFTER FLIGHT IN KOSMOS-605 SATELLITE

V. V. Portugalov, A. A. Ivanov, and V. N. Shvets *In its* Space Biol. and Aerospace Med., No. 3, 1977 (JPRS-69380) 7 Jul. 1977 p 102-105 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmich. Med., (USSR), no. 3, 1977 p 76-78 (For availability see N78-18715 09-52)

Avail: NTIS HC A07/MF A01

Prolonged stays of animals and man in a sealed space were associated with reduction of automicroflora, leading to reduction of the immunocompetent system and impairment of natural immunity. Hypodynamia was another factor of space flights that lowered immunological reactivity. Immunological reactions were usually mediated in the organism through humoral factors: specific (antibodies) and nonspecific (blood serum complement). The levels of heterophilic antibodies in peripheral blood were consistent with the capacity of lymphoid tissue cells to produce antibodies. Author

N78-18732# Joint Publications Research Service, Arlington, Va.

MEASUREMENT OF RADIATION DOSES IN THE SOYUZ-16 SPACECRAFT

Yu. A. Akatov, Ye. Ye. Kovalev, V. M. Petrov, M. V. Teltsov, and V. I. Shumshurov *In its* Space Biol. and Aerospace Med., No. 3, 1977 (JPRS-69380) 7 Jul. 1977 p 106-107 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmich. Med. (USSR), no. 3, 1977 p 78-79 (For availability see N78-18715 09-52)

Avail: NTIS HC A07/MF A01

Orbital parameters determined the characteristics of the radiation conditions on the path and in the craft, as well as the specifications with regard to the system of monitoring them. An R-15 dosimeter was installed to measure the integral dose of cosmic radiation; it provided the necessary information for the ground-based radiation safety service. The instrument was equipped with an ionization chamber of plexiglas that was filled with argon. During operation, the ionization current in the chamber was converted into pulses. Data on galactic cosmic radiation during the period of minimal solar activity and the map of distribution of proton and electron flows at different altitudes were used. The effect of solar cosmic rays on radiation dose rate was not determined, since the forecast covering several days showed a very low level of solar activity and lack of bursts causing radiation. Author

N78-18733# Joint Publications Research Service, Arlington, Va.

BLOOD CLOTTING FUNCTION DURING 12-DAY IMMERSION IN WATER, AND THE PREVENTIVE ROLE OF REVOLVING ON A CENTRIFUGE

M. A. Khudyakova and Ye. B. Shulzhenko *In its* Space Biol. and Aerospace Med., No. 3, 1977 (JPRS-69380) 7 Jul. 1977 p 108-112 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmich. Med. (USSR), no. 3, 1977 p 79-81 (For availability see N78-18715 09-52)

Avail: NTIS HC A07/MF A01

The changes in various indices of homeostasis, hypodynamia, and coagulation were studied. It was determined whether it was possible to use increased gravitation for prevention of decondition of the organism during immersion. Author

N78-18734# Joint Publications Research Service, Arlington, Va.

DEFENSE REACTIONS OF THE ORGANISM WHILE BREATHING HIGH CONCENTRATIONS OF CARBON DIOXIDE

O. Yu. Sidorov and Z. K. Sulimo-Samuyllo *In its* Space Biol. and Aerospace Med., No. 3, 1977 (JPRS-69380) 7 Jul. 1977 p 113-116 Transl. into ENGLISH from Kosm. Biol. Aviakosmich. Med. (USSR), no. 3, 1977 p 81-83 (For availability see N78-18715 09-52)

Avail: NTIS HC A07/MF A01

The effects of increasing and stationary concentrations of CO2 were studied in people. The features of development of defense reactions of the organism under the influence of high concentrations of carbon dioxide were established, especially their effectiveness in controlling developing hypercapnia. The subjects' pulmonary ventilation, composition of alveolar air, pulse rate, blood pressure and EKG were recorded. In addition, in the long-term experiments, the reserve alkalinity of blood, erythrocyte count, hemoglobin, potassium, proteins, amino acids, and blood pH were estimated. Author

N78-18735# Joint Publications Research Service, Arlington, Va.

EFFECT OF GAMMA RADIATION ON INTENSITY OF AMMONIA EXCRETION IN ALBINO RATS

K. P. Bugar, V. V. Kustov, B. I. Abidin, and L. T. Poddubnaya *In its* Space Biol. and Aerospace Med., No. 3, 1977 (JPRS-69380) 7 Jul. 1977 p 117-120 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmich. Med. (USSR), no. 3, 1977 p 83-84 (For availability see N78-18715 09-52)

Avail: NTIS HC A07/MF A01

Experimental results revealed that gamma radiation had no effect on excretion of ammonia by irradiated animals with a dosage of 100 rad, whereas in doses of 300 rad and 650 rad it lowered excretion. The lower intensity of elimination after exposure to ionizing radiation was due to the impaired functional state of the gastrointestinal system, the main supplier of ammonia. Author

N78-18736# Joint Publications Research Service, Arlington, Va.

OTOLITH SYSTEM FUNCTION IN COSMONAUTS FOLLOWING SPACE MISSIONS

F. A. Solodovnik *In its* Space Biol. and Aerospace Med., No. 3, 1977 (JPRS-69380) 7 Jul. 1977 p 121-123 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmich. Med. (USSR), no. 3, 1977 p 85-86 (For availability see N78-18715 09-52)

Avail: NTIS HC A07/MF A01

Swinging at low amplitude stimulates the otolithic system in man. All of the cosmonauts perceived accurately the start of swinging under the influence of low linear accelerations, and they determined the direction of movement of the swing after increases in swinging amplitude. A comparison of the results of testing threshold levels of linear accelerations before and after space flights failed to demonstrate appreciable differences. Author

N78-18737# Joint Publications Research Service, Arlington, Va.

SUDDEN LOSS OF CONSCIOUSNESS IN PILOTS WITH LOW INTRAOCULAR PRESSURE DURING EXPOSURE TO G FORCES

Yu. Domashuk and M. Voytkovyak *In its* Space Biol. and Aerospace Med., No. 3, 1977 (JPRS-69380) 7 Jul. 1977 p 124-125 refs Transl. into ENGLISH from Kosm. Biol. Aviakosmich. Med. (USSR), no. 3, 1977 p 86-87 (For availability see N78-18715 09-52)

Avail: NTIS HC A07/MF A01

During linear increment of G forces at the rate of 0.1 units/s, marked impairment of peripheral vision occured at 8 to 12 s prior to loss of consciousness. However, mass screening of pilots on a centrifuge (determination of range of endurance with intact vision with linear increment of G forces) revealed instances when loss of consciousness was not preceded by disturbances referable to vision. Experimental results revealed that low intraocular pressure during exposure to G forces may be the cause. Author

N78-18738# Joint Publications Research Service, Arlington, Va.

SPACE BIOLOGY AND AEROSPACE MEDICINE, NO. 4, 1977

14 Oct. 1977 129 p refs Transl. into ENGLISH from Kos. Biol. Aviakos. Med. (Moscow), no. 4, 1977 p 1-87 (JPRS-69964) Avail: NTIS HC A07/MF A01

Space flight stresses were investigated in regard to protein biosynthesis, vestibulotonic reflexes, aseptic inflammation, blood chemistry, blood circulation, personality traits, autonomic disorders, altitude-decompression disorders, and hypertension in cosmonauts. Aspects of space flight considered included weightlessness, cyclic and acyclic locomotion, hypokinesia, super intensity constant magnetic fields, and gamma radiation. For individual titles, see N78-18739 through N78-18759.

N78-18739# Joint Publications Research Service, Arlington, Va.

PRINCIPAL METHODS OF SIMULATING BIOLOGICAL EFFECTS OF WEIGHTLESSNESS

Ye. A. Kovalenko *In its* Space Biol. and Aerospace Med., No. 4, 1977 (JPRS-69964) 14 Oct. 1977 p 1-9 refs Transl. into ENGLISH from Kos. Biol. Aviakos. Med. (Moscow), no. 4, 1977 p 3-9 (For availability see N78-18738 09-52)

Avail: NTIS HC A07/MF A01

Methods of simulating and modeling the effects of weightlessness on the living organism under ground-based conditions were systematized. Methods of partial simulation of the effects of weightlessness were based on the feasibility of reproducing some elements of the mechanism of effects of weightlessness on the organism. Three main categories of modeling were distinguished: (1) decreasing the effect of gravity on the organism; (2) creating a variable effect of gravity on the organism and (3) simulation of different effects of pathogenesis of weightlessness on the organism by means of biological procedures. Each of these categories was divided into groups of specific methods of modeling weightlessness. Author

N78-18740# Joint Publications Research Service, Arlington, Va.

DYNAMICS OF CYCLIC AND ACYCLIC LOCOMOTION OF THE SOYUZ-18 CREW AFTER A 63-DAY SPACE MISSION

I. F. Chekirda and A. V. Yeremin *In its* Space Biol. and Aerospace Med., No. 4, 1977 (JPRS-69964) 14 Oct. 1977 p 10-15 refs Transl. into ENGLISH from Kos. Biol. Aviakos. Med. (Moscow), no. 4, 1977 p 9-13 (For availability see N78-18738 09-52)

Avail: NTIS HC A07/MF A01

The dynamics of locomotor activity of cosmonauts during the readaptation period were investigated through the use of electromyography and photocyclography. Tests were done to aid in the selection of optimal rehabilitation measures, motor activity and physical exercise. Evaluations of the effects of long flights on the motor system were also made possible. Author

N78-18741# Joint Publications Research Service, Arlington, Va.

MEDICAL SUPPORT OF THE IMMEDIATE POSTFLIGHT PERIOD FOLLOWING LONG SPACE MISSIONS

L. L. Stazhadze, V. V. Bogomolov, and I. R. Goncharov *In its* Space Biol. and Aerospace Med., No. 4, 1977 (JPRS-69964) 14 Oct. 1977 p 16-19 refs Transl. into ENGLISH from Kos. Biol. Aviakos. Med. (Moscow), no. 4, 1977 p 14-16 (For availability see N78-18738 09-52)

Avail: NTIS HC A07/MF A01

The scientific methodological aspects of organizing resuscitation and anesthesiological care of acute, emergency states in the early readaptation period following lengthy, manned space flights are discussed. Author

N78-18742# Joint Publications Research Service, Arlington, Va.

DNA STATUS IN RAT LIVER AND SPLEEN FOLLOWING FLIGHT ON KOSMOS-605 SATELLITE

G. S. Komolova, F. T. Guseynov, V. F. Makeyeva, I. A. Yegorov, R. A. Tigranyan, and L. V. Serova *In its* Space Biol. and Aerospace Med., No. 4, 1977 (JPRS-69964) 14 Oct. 1977 p 20-23 refs Transl. into ENGLISH from Kos. Biol. Aviakos. Med. (Moscow), no. 4, 1977 p 17-19 (For availability see N78-18738 09-52)

Avail: NTIS HC A07/MF A01

The effect of space flight factors on nucleic acid metabolism and structure was investigated. Liver and spleen tissues of rats carried in Kosmos-605 were analyzed for nucleic acid content and DNA structure. Total nucleic acids and DNA were assayed by the two-wave method, using spectrophotometry. Results showed no change in DNA content of the liver following the space flight, whereas RNA level dropped by 14%. RNA content in the spleen dropped by 19%. Author

N78-18743# Joint Publications Research Service, Arlington, Va.

EFFECT OF PROLONGED SPACE FLIGHT ON PROTEIN BIOSYNTHESIS IN VARIOUS RAT ORGANS AND TISSUES

E. A. Rapoport, L. A. Goncharova, S. A. Morenkova, and V. A. Kazaryan *In its* Space Biol. and Aerospace Med., No. 4, 1977 (JPRS-69964) 14 Oct. 1977 p 24-29 refs Transl. into ENGLISH from Kos. Biol. Aviakos. Med. (Moscow), no. 4, 1977 p 20-24 (For availability see N78-18738 09-52)

Avail: NTIS HC A07/MF A01

In view of the correlation between the physiological status of cells and tissues and the course of protein biosynthesis in them, protein biosynthesis was studied using the method of isotope tracers. Materials studied included parenchymous organs, the myocardium and some skeletal muscles of rats. Experiments were done on the 2nd and 26th days following a 22 day space flight aboard Kosmos-605. Results indicate that a 22 day space flight does not elicit any specific changes in the biosynthesis of proteins in most of the organs studied. Author

N78-18744# Joint Publications Research Service, Arlington, Va.

CYTOCHEMICAL STUDIES OF PROTEINS AND RNA IN INDIVIDUAL SPINAL CORD MOTONEURONS AND SPINAL GANGLIA NEURONS OF RATS FOLLOWING A SPACE FLIGHT

A. V. Gorbundova and V. V. Portugalov *In its* Space Biol. and Aerospace Med., No. 4, 1977 (JPRS-69964) 14 Oct. 1977 p 30-35 refs Transl. into ENGLISH from Kos. Biol. Aviakos. Med. (Moscow), no. 4, 1977 p 24-28 (For availability see N78-18738 09-52)

Avail: NTIS HC A07/MF A01

Changes in RNA and protein content of motoneurons of the anterior cornua of the spinal cord and sensory neurons of spinal ganglia of rats, used in a 22-day space flight were examined. Rats kept in the vivarium and used in a groundbased model experiment, in which most of the factors of space flights were simulated, served as controls. Several categories of neurons were distinguished, which differed in size and other parameters. Separate studies of small medium and large neurons were made. It was established that different groups of neurons react differently. Tables show that a 22-day space flight was not associated with changes in RNA content of medium and small neurons of the spinal ganglia. Author

N78-18745# Joint Publications Research Service, Arlington, Va.

VESTIBULOTONIC REFLEXES IN MUSCLES OF THE RAT HIND LIMB FOLLOWING A FLIGHT ON KOSMOS-605

Z. I. Apanasenko *In its* Space Biol. and Aerospace Med., No. 4, 1977 (JPRS-69964) 14 Oct. 1977 p 36-42 refs Transl. into ENGLISH from Kos. Biol. Aviakos. Med. (Moscow), no. 4, 1977 p 28-34 (For availability see N78-18738 09-52)

Avail: NTIS HC A07/MF A01

The changes in characteristics of vestibulotonic reflexes in skeletal muscles of animals under the influence of space flight contitions were studied. According to classical experiments, such a reflex originates in the sensory utricular maculae when there is a change in spatial position of the body. Thus, the changes in parameters of the reflex should reflect, to some extent, the functional state of the vestibular analyzer, and mainly of its otoliths. Electromyograms were recorded using silver plate electrodes on the group of femoral extensor muscles. The electrodes, mounted in a thin plastic plate, were attached to the limbs with adhesive tape. A special device was used to integrate action currents of muscles concurrently with the ink tracing on paper; total electric activity was expressed in relative units on electronic counters. Results indicate increased periods of electric activity as an aftereffect to adequate vestibular stimulation. Author

N78-18746# Joint Publications Research Service, Arlington, Va.

CLINICAL AND BIOCHEMICAL ASPECTS OF HUMAN ADAPTATION TO CENTRAL ANTARCTICA AS APPLIED TO PROBLEMS OF SPACE BIOLOGY AND MEDICINE

V. V. Kurbanov, V. P. Khmelkov, T. N. Krupina, A. G. Kuznetsov, M. P. Kuzmin, Yu. N. Purakhin, N. I. Tsyganova, and N. N. Mukhina *In its* Space Biol. and Aerospace Med., No. 4, 1977 (JPRS-69964) 14 Oct. 1977 p 43-50 refs Transl. into ENGLISH from Kos. Biol. Aviakos. Med. (Moscow), no. 4, 1977 p 34-41 (For availability see N78-18738 09-52)

Avail: NTIS HC A07/MF A01

Human adaptation to extreme environmental conditions was studied using prevailing conditions in central Antarctica. Biological rhythms and effects of extreme factors were monitored in a group of individuals after prolonged isolation at a station in Vostok. Results are given on psychological and physiological changes caused by deleterious environmental factors. Author

N78-18747# Joint Publications Research Service, Arlington, Va.

EFFECT OF PROLONGED HYPOKINESIA ON THE COURSE OF ACUTE ASEPTIC INFLAMMATION

P. V. Vasilyev, V. Ye. Belay, N. A. Gaydakin, G. D. Glod, V. E. Lysak, Ye. P. Melnikova, S. V. Petrukhin, and N. N. Uglova *In its* Space Biol. and Aerospace Med., No. 4, 1977 (JPRS-69964) 14 Oct. 1977 p 51-57 refs Transl. into ENGLISH from Kos. Biol. Aviakos. Med. (Moscow), no. 4, 1977 p 41-46 (For availability see N78-18738 09-52)

Avail: NTIS HC A07/MF A01

Studies, conducted on rats, investigated the effect of different periods of hypokinesia on the course of inflammation; the effect of the duration of readaptation; and the distinctions of development of an inflammatory process against the background of continued restricted mobility. Inflammation was produced by administration of 3% formalin under the planter aponeurosis of hind limb under aseptic conditions. The dynamics of the inflammatory reaction were assessed according to local changes and some systemic changes. Hyperemia and edema developed within minutes after the injection, but gradually diminished starting on the 3rd through 5th days, and by the 7th through 10th days all outward signs of aseptic inflammation disappeared. Author

N78-18748# Joint Publications Research Service, Arlington, Va.

EFFECTS OF CHRONIC EXPOSURE TO CARBON MONOXIDE ON BIOCHEMISTRY OF HUMAN BLOOD

M. V. Markaryan, T. A. Smirnova, and O. S. Khokhlova *In its* Space Biol. and Aerospace Med., No. 4, 1977 (JPRS-69964) 14 Oct. 1977 p 58-63 refs Transl. into ENGLISH from Kos. Biol. Aviakos. Med. (Moscow), no. 4, 1977 p 46-50 (For availability see N78-18738 09-52)

Avail: NTIS HC A07/MF A01

Some aspects of protein, carbohydrate and lipid metabolism in man were studied as related to prolonged and continuous exposure to different concentrations of carbon monoxide. Work was done in order to set the maximum permissible concentrations of carbon monoxide in the atmosphere of pressurized areas. Experiments were conducted on human subjects in pressurized chambers which held various concentrations of carbon monoxide. Total protein in blood serum was assayed by refractometry, protein fractions by means of electrophoresis, and total lipids by the turbidimetric method. Cholesterol, lipoproteins, and blood sugar were also monitored. It was found that the continuous 30-day exposure of man to carbon monoxide in a concentration of 20 to 15 mg/cu m led to impairment of metabolic processes, manifested by an increase in albumins, globulins, total lipids, cholesterol, and lipoproteins and a decrease in blood sugar concentration. Author

N78-18749# Joint Publications Research Service, Arlington, Va.

EFFECT OF SUPERHIGH INTENSITY CONSTANT MAGNETIC FIELDS ON MORPHOLOGICAL COMPOSITION OF PERIPHERAL BLOOD

A. G. Borodkina and Z. N. Nakhilnitskaya *In its* Space Biol. and Aerospace Med., No. 4, 1977 (JPRS-69964) 14 Oct. 1977 p 64-68 refs Transl. into ENGLISH from Kos. Biol. Aviakos. Med. (Moscow), no. 4, 1977 p 50-55 (For availability see N78-18738 09-52)

Avail: NTIS HC A07/MF A01

Experimental mice were exposed to horizontal constant magnetic force, CMF, and hemoglobin levels and erythrocytes were assayed. Exposure of mice to CMF of 9.9, 25.4 and 39.4 kOe elicited changes in reticulocyte and leukocyte content of peripheral blood. A persistent and prolonged decrease in number of reticulocytes with concurrent decrease in leukocytes was observed, which was apparently related to depression of erythopoiesis and leukopoiesis. Author

N78-18750# Joint Publications Research Service, Arlington, Va.

ORGANISM REACTIONS TO HYPOXIA FOLLOWING EXPOSURE TO GAMMA RADIATION

B. I. Davydov and V. V. Antipov *In its* Space Biol. and Aerospace Med., No. 4, 1977 (JPRS-69964) 14 Oct. 1977 p 69-74 refs Transl. into ENGLISH from Kos. Biol. Aviakos. Med. (Moscow), no. 4, 1977 p 55-59 (For availability see N78-18738 09-52)

Avail: NTIS HC A07/MF A01

The correlation between time of exposure to hypoxia and mortality can be described as a cumulative function (performance curve). For this reason, the method of probit analysis was used to calculate both the mean effective time of animal death and animal death in the case of a fixed time of exposure to hypoxia. In addition, the median time was calculated. In the latter case, radiation death without hypoxia was evaluated as zero time. The arithmetic mean time was determined only for mice that died within 30 minute exposure to hypoxia. Author

N78-18751# Joint Publications Research Service, Arlington, Va.

CATARACTOGENIC EFFECT OF 25 AND 50 MeV PROTONS

A. N. Kabachenko and B. S. Fedorenko *In its* Space Biol. and Aerospace Med., No. 4, 1977 (JPRS-69964) 14 Oct. 1977 p 75-79 refs Transl. into ENGLISH from Kos. Biol. Aviakos. Med. (Moscow), no. 4, 1977 p 59-62 (For availability see N78-18738 09-52)

Avail: NTIS HC A07/MF A01

It was established that 25 and 50 MeV protons had definite cataractogenic activity. The incidence of lenticular opacities occurring under the influence of protons was a function of dosage and postradiation time. The linear nature of incidence of opacities as function of dose and postradiation time was indicative of absence of correlation between or vulnerability to radiation. Distinctions of formations of different grades of opacities were studied, and revealed consistent development of radiation cataract under the influence of protons and X rays. Author

N78-18752# Joint Publications Research Service, Arlington, Va.

ACUTE LEUKOCYTIC REACTIONS TO IMPACT ACCELERATIONS

Ye. Ye. Simonov *In its* Space Biol. and Aerospace Med., No. 4, 1977 (JPRS-69964) 14 Oct. 1977 p 80-85 refs Transl. into ENGLISH from Kos. Biol. Aviakos. Med. (Moscow), no. 4, 1977 p 62-67 (For availability see N78-18738 09-52)

Avail: NTIS HC A07/MF A01

Data indicated that the blood leukocyte level did not remain unchanged in the experimental animals. An increase in leukocytes was observed under the influence of mild stimuli, related to transportation, immobilization of the animals and nondeleterious landing-related accelerations. Reactions were a special manifestation of the organisms' general defense reactions. Only changes observed in experiments with intolerable accelerations were classified as the pathological type of acute leukocytic reaction. Author

N78-18753# Joint Publications Research Service, Arlington, Va.

INVESTIGATION OF PERSONALITY TRAITS OF PILOTS AND NAVIGATORS

N. F. Lukyanova, V. I. Polyanskiy, and Ye. N. Lokshina *In its* Space Biol. and Aerospace Med., No. 4, 1977 (JPRS-69964) 14 Oct. 1977 p 86-91 refs Transl. into ENGLISH from Kos. Biol. Aviakos. Med. (Moscow), no. 4, 1977 p 67-70 (For availability see N78-18738 09-52)

Avail: NTIS HC A07/MF A01

Results showed that achievement of high results in the professional activities of pilots and navigators was related to personality distinctions and correct choice of flying as a specialty. The data had a direct bearing on improvements of occupational psychological screening for flight schools. Examination of candidate's personality traits made it possible to evaluate more fully and accurately, fitness for flight training. It also provided a more substantiated individual approach to the educational and training process, as well as psychological training of flight personnel. Author

N78-18754# Joint Publications Research Service, Arlington, Va.

TETRAPOLAR RHEOGRAPHY USED TO EVALUATE THE CIRCULATORY SYSTEM

I. B. Tikhomirov, V. F. Turchaninova, V. T. Selivanenko, and V. A. Staferov *In its* Space Biol. and Aerospace Med., No. 4, 1977 (JPRS-69964) 14 Oct. 1977 p 92-96 refs Transl. into ENGLISH from Kos. Biol. Aviakos. Med. (Moscow), no. 4, 1977 p 70-74 (For availability see N78-18738 09-52)

Avail: NTIS HC A07/MF A01

The rheographic method was based on the existence of a close link between cardiac function and pulsed fluctuations of tissular resistance. The results obtained were indicative of the feasibility of using tetrapolar rheography: it permitted qualitative and quantitative evaluation of pulsed delivery of blood to the region examined. A comparison of cardiac output obtained by rheography and the dye dilution method revealed a high degree of correlation. Author

N78-18755# Joint Publications Research Service, Arlington, Va.

CARBOHYDRATE AND LIPID CONTENT OF RAT LIVER TISSUE FOLLOWING A 22-DAY SPACE FLIGHT

R. A. Belitskaya *In its* Space Biol. and Aerospace Med., No. 4, 1977 (JPRS-69964) 14 Oct. 1977 p 97-99 refs Transl. into ENGLISH from Kos. Biol. Aviakos. Med. (Moscow), no. 4, 1977 p 75-76 (For availability see N78-18738 09-52)

Avail: NTIS HC A07/MF A01

Space flight did not affect total carbohydrate content of the liver, but it led to an increase in lipids and phospholipids, which

reverted to normal in the postflight period. However, the weightlessness factor could have elicited only an increase in phospholipids. Author

N78-18756# Joint Publications Research Service, Arlington, Va.

CHANGES IN CIRCULATING BLOOD VOLUME AND FILLING OF THE BRAIN AND INTERNAL ORGANS OF RATS FOLLOWING ACUTE AND CHRONIC HYPOXIA

M. A. Kolesov and M. N. Shcherbakova *In its* Space Biol. and Aerospace Med., No. 4, 1977 (JPRS-69964) 14 Oct. 1977 p 100-105 refs Transl. into ENGLISH from Kos. Biol. Aviakos. Med. (Moscow), no. 4, 1977 p 76-80 (For availability see N78-18738 09-52)

Avail: NTIS HC A07/MF A01

Results showed that acute hypoxia induced redistribution of blood flow in the direction of predominant delivery of blood to the heart, brain and liver at the expense of decreased delivery to other organs. These changes were transient and functional in nature. As a result of multiple exposure of animals to a hypoxic environment, the changes in the vascular bed became structurally fixed and were demonstrable for a period of time. There was correlation between the change in circulating blood volume and filling of organs in the presence of hypoxia. Author

N78-18757# Joint Publications Research Service, Arlington, Va.

THE HEMATIC SYSTEM IN THE SET OF SYMPTOMS OF AUTONOMIC DISORDERS IN MONKEYS ON THE LOW GRAVITATION STAND

G. S. Belkaniya and M. I. Kuksova *In its* Space Biol. and Aerospace Med., No. 4, 1977 (JPRS-69964) 14 Oct. 1977 p 106-111 refs Transl. into ENGLISH from Kos. Biol. Aviakos. Med. (Moscow), no. 4, 1977 p 80-83 (For availability see N78-18738 09-52)

Avail: NTIS HC A07/MF A01

Signs of stimulation of hemopoiesis, as reflected by increased erythroblast activity of medullary hemopoiesis: an increase in erythroid cells on the myelogram, and an increase in amount of erythrocytes, reticulocytes and hemoglobin in blood were observed. Erythroblastosis was particularly marked after restoration of the usual characteristics of the static reaction and motor activity of the monkeys. In addition, the poststand period was characterized by marked lability with regard to composition of peripheral blood, and this corresponded to instability of automatic regulation of other physiological systems of the organism and persistence of marked orthostatic insufficiency. Author

N78-18758# Joint Publications Research Service, Arlington, Va.

RELATIONSHIP BETWEEN ONSET OF ALTITUDE-DECOMPRESSION DISORDERS IN MAN AND BAROMETRIC PRESSURE LEVEL DURING INTENSIVE PHYSICAL EXERCISE

M. I. Vakar, A. N. Mazin, A. S. Tsivilashvili, and V. V. Malchikov *In its* Space Biol. and Aerospace Med., No. 4, 1977 (JPRS-69964) 14 Oct. 1977 p 112-115 refs Transl. into ENGLISH from Kos. Biol. Aviakos. Med. (Moscow), no. 4, 1977 p 83-85 (For availability see N78-18738 09-52)

Avail: NTIS HC A07/MF A01

With onset of altitude-decompression disorders, an increase in time required to write letters and words was observed. A decrease in capacity of the visual analyzer was also shown. This was indicative of intensification of the inhibitory process in the cerebral cortex. Concurrently, an elevation of rectal and weighted mean body temperature was noted, which was interpreted as a distinctive nervous reflex reaction accompanying decompression disorders. Author

N78-18759# Joint Publications Research Service, Arlington, Va.

PREVENTION OF HYPERTENSIVE STATES IN SHIP CREWS OUT AT SEA

V. N. Barnatskiy, A. G. Kuznetsov, V. A. Kotenko, B. I. Goryayev, M. V. Pimenova, and Yu. S. Slobodchuk *In its* Space Biol. and Aerospace Med., No. 4, 1977 (JPRS-69964) 14 Oct. 1977 p 116-119 Transl. into ENGLISH from Kos. Biol. Aviakos. Med., (Moscow), no. 4, 1977 p 85-87 (For availability see N78-18738 09-52)

Avail: NTIS HC A07/MF A01

Pathology of the cardiovascular system, and particularly essential hypertension, was one of the causes of diminished fitness of seamen and subsequent grounding for health reasons. Studies conducted on ships in the course of long-term cruises established that no arterial pressure drop was observed during storms among seamen susceptible to seasickness after intravenous and rectal administration of sodium hydrocarbonate (NaHCO3), whereas it did drop significantly in a control group. Concurrently, it was observed that NaHCO3 had a hypotensive effect on seamen with high arterial pressure. Studies were conducted at different latitudes in the ocean to test the hypotensive effect of NaHCO on ship crews. It was planned to develop methods of using NaHCO3 to prevent hypertensive states in seamen. Author

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N78-18760# City Univ. of New York. School of Liberal Arts and Science.

EVOKED CORTICAL POTENTIALS AND INFORMATION PROCESSING Annual Report, 1 Jan. - 31 Dec. 1977

John L. Andreassi, Joseph A. Gallichio, and Nancy E. Young 31 Dec. 1977 79 p refs

(Contract N00014-77-C-0114)

(AD-A048647) Avail: NTIS HC A05/MF A01 CSCL 06/4

The present report details the results of five separate experiments. Experiment I examines the visual evoked potential (VEP) to a target stimulus when it is perceptually masked by a second stimulus, and again when it is disinhibited. In experiment II, the effects of contiguity of target (initial) and mask (later) visual stimuli on backward masking and the VEP was examined. Significant VEP amplitude decreases occurred when the target was followed closely in time by either of the masks. Experiment III tested the effects of differing numbers of corner masks on perception of, and VEP to, the target stimuli. In experiment IV we asked whether corner masking stimuli would be more effective than non-corner masks with respect to effects on perception and the VEP. Both corner and non-corner masks occupied less area than the target stimuli (57%). The fifth experiment examined the effects of a randomly generated noise pattern on a target. The target was a letter T and the mask overlapped and crisscrossed the T at many points along its contour. The random visual pattern proved to be a very effective mask perceptually and also led to sharp decreases in VEP amplitude. The general finding of VEP attenuation with backward masking was interpreted in terms of excitatory-inhibitory interactions at the visual cortex which occur when later presented stimuli bound, or spatially overlap, earlier presented target stimuli. GRA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N78-18761* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

EMERGENCY SPACE-SUIT HELMET Patent

Harvey A. Smith, inventor (to NASA) (United Aircraft Corp., East Hartford, Conn.) Issued 2 Jun. 1970 7 p Filed 24 Feb. 1966 Sponsored by NASA

(NASA-Case-MSC-10954-1; US-Patent-3,514,785; US-Patent-Appl-SN-529884; US-Patent-Class-2-2.1) Avail: US Patent Office CSCL 06K

A frusto-conically shaped distensible component is described which inflates to encircle a portion of the wearer's head and carries a collapsible member which automatically extends over the remaining portion of the head. A pulley arrangement secured

between the walls of the distensible component automatically extends and retracts the collapsible member. When deflated, the unit is carried on the back of the wearer so as to provide an automatic emergency space suit helmet.

Official Gazette of the U.S. Patent Office

N78-18762*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

DROP FOOT CORRECTIVE DEVICE Patent Application

Bert C. Deis, inventor (to NASA) Filed 9 Feb. 1978 11 p (NASA-Case-LAR-12259-1; US-Patent-Appl-SN-876298) Avail: NTIS HC A02/MF A01 CSCL 06B

A drop foot corrective device to alleviate a plurality of difficulties encountered in walking by a victim suffering from a drop foot condition is presented. The invention consists essentially of an apparatus including a legband positionable to girdle the afflicted leg of the victim above the calf and below the knee, retaining and supporting the joint with a flexible ligament affixed to and extending from a toe of the foot or the toe of a shoe worn on the foot to the legband where it is anchored. The novel feature of the device appears to lie in its unique structure which alleviates the problem of drop foot by providing the support needed and the flexibility required, and furthermore is inexpensive, lightweight, inconspicuous, easily transferable from shoe to shoe, and may be worn with bare feet. NASA

N78-18763*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

SPACESUIT MOBILITY JOINTS Patent Application

Hubert C. Vykukal, inventor (to NASA) Filed 3 Mar. 1978 45 p (NASA-Case-ARC-11058-2; US-Patent-Appl-SN-883094) Avail: NTIS HC A03/MF A01 CSCL 05H

A spacesuit is presented having a waist joint, shoulder joints, elbow joints, hip joints, and ankle joints. Each of the joints includes at least one pair of annuli supported for pivotal displacement about paralleling axes and a flexible, substantially impermeable diaphragm of a tubular configuration spanning the distance between the annuli and connected thereto in a hermetically sealed relationship. The diaphragm includes at least one rolling convolution having a crown disposed in a fixed relation with an axis about which one of the annuli pivots. The knee joint is constructed slightly different from the other joints. A curved tubular shell is disposed between two circular bellows. Cables are secured to the rings, shell, and bellows. The cables limit the motion of the bellows when the suit is pressurized. NASA

N78-18764# Army Tropic Test Center, APO New York 09827.

A NEW APPROACH TOWARD OBTAINING QUANTIFIED SUBJECTIVE TEST DATA Final Report

R. L. Williamson and D. A. Dobbins May 1977 24 p refs (AD-A047838; USATTC-7705001) Avail: NTIS HC A02/MF A01 CSCL 05/5

This report proposes a method for obtaining ratio-scaled response data during subjective questioning of soldiers whose opinions are solicited during Army materiel tests. The approach is an adaptation of psychophysical measurement methods developed in recent years. Types of measurement scales are reviewed; a tentative taxonomy of psychophysical terminology is proposed. Methods and instrumentation for selecting and validating response modes are outlined. Plans for using resultant subjective measures of effectiveness in parametric models for statistical inference are suggested. Author (GRA)

N78-18765# Systems Technology, Inc., Hawthorne, Calif.

AN INTRODUCTION TO V/STOL TECHNOLOGY AFFECTING THE PILOT'S ROLE

Robert F. Ringland Dec. 1977 46 p refs (Contract N60530-77-M-H604) (AD-A048214; NWC-TP-5996) Avail: NTIS HC A03/MF A01 CSCL 01/3

This report provides introductory material on the aerodynamics, propulsion, and flight control for V/STOL aircraft. Certain basic aspects of V/STOL technology and hardware are outlined, and deficiencies in past V/STOL aircraft which adversely impact the pilot's performance are discussed. The report is intended to provide background material on the human factors aspects of future V/STOL aircraft development. GRA

N78-18766# Army Aeromedical Research Unit, Fort Rucker, Ala.

THE HELMET PROTECTS THE AVIATOR'S HEAD - OR DOES IT

Gerald L. Johnson and John J. Treanor Oct. 1977 5 p (AD-A048574) Avail: NTIS HC A02/MF A01 CSCL 06/17

This paper examines the need for trained life support equipment specialists to maintain the protective capability of Army aviator's helmets (SPH-4). One-hundred helmets selected at random from the user population were evaluated for ability to attenuate impact forces, attenuate noise, and afford eye protection to the Army aviator. The evaluation revealed that protection was compromised in the majority of helmets in all three functional areas. The individual airman is responsible for maintaining his own equipment, no trained equipment personnel are available to inspect or maintain the helmets. The applicability of such a survey is suggested in the case of motorcycle and construction helmets. GRA

N78-18767# Naval Air Development Center, Warminster, Pa.

A PERSONAL COOLING SYSTEM FOR HELICOPTER PILOTS Phase Reports, 1 Oct. 1976 - 30 Sep. 1977

Suzanne M. Reeps 21 Nov. 1977 14 p refs (AD-A047649; NADC-77289-60) Avail: NTIS HC A02/MF A01 CSCL 06/17

The NAVAIRDEVCEN (Naval Air Development Center) is developing a personal cooling system for helicopter pilots to alleviate the heat stress encountered during exposure to high ambient temperatures. The major components of this system are a lightweight, constant-wear, liquid circulating garment (LCG) outfitted with skin temperature sensors, a cooling generator, and an automatic controller. The liquid circulation garment is designed for wear under a standard flight coverall and is connected, upon aircraft entry, to the generator and automatic controller. During flight, the system automatically maintains the pilot and copilot in thermal comfort thereby enabling more effective performance of flight duties. The system is currently under a development contract. Author (GRA)

N78-18768# Human Engineering Labs., Aberdeen Proving Ground, Md.

HUMAN ENGINEERING LABORATORY IDENTIFICATION FRIEND OR FOE TEST (HELIFF) Final Report

John A. Barnes Oct. 1977 53 p refs (AD-A048784; HEL-TM-30-77) Avail: NTIS HC A04/MF A01 CSCL 05/4

This study tested the ability of qualified helicopter gunners to detect and to identify moving tactical vehicles of the United States and its allies and the Warsaw Pact countries as either friend or foe. The gunners observed the vehicles from a tower which simulated a gunship in the hover position. The data shows the mean time and mean range differences between the detection and the identification of the moving tactical vehicles both with the use of 10-power optics and with unaided vision. The percentage of correct identifications is also given.

Author (GRA)

N78-18769# Texas Technological Univ., Lubbock. Dept. of Industrial Engineering.

SELECTED DESIGN PARAMETERS FOR RECLINING SEATS BASED ON ENGINEERING ANTHROPOMETRY Final Report

M. M. Ayoub, S. Deivanayagam, and Kenneth W. Kennedy Sep. 1977 162 p refs (Contract F33615-75-C-5013) (AD-A048458; AMRL-TR-77-44) Avail: NTIS HC A08/MF A01 CSCL 05/5

This report discusses selected engineering anthropometric design criteria for reclining cockpit seats. The reclining back-rest positions selected were 13, 27, 51 and 65 deg from the vertical line through the seat reference point (SRP). Two seat pan angles of 10 and 20 deg were utilized. Three seating components were considered in this report, these are: the head rest, arm rest, and foot rest. The specific engineering anthropometric design parameters addressed were: the head rest hinge point location, arm rest location and orientation in space as the seat reclines, location of foot rests and the synchronization of arm rest movement with back rest inclination. Author (GRA)

N78-18770# Advisory Group for Aerospace Research and Development, Paris (France).
ASSESSING PILOT WORKLOAD
Feb. 1978 83 p refs
(AGARD-AG-233; ISBN-92-835-74-X) Avail: NTIS HC A05/MF A01

Pilot workload was defined and classified according to physical and mental stresses. The need for workload assessment was summarized while principles and methods of subjective assessment were discussed. Physiological tests used in the assessment of workload were presented. Tests recorded the functions of the respiratory, nervous, and cardiovascular systems. B.L.P.

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

N78-18771*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE (SETI)
Philip Morrison, ed. (MIT, Cambridge), John Billingham, ed., and John Wolfe, ed. 1977 289 p refs
(NASA-SP-419) Avail: NTIS MF A01; SOD HC $4.50 CSCL 06C

A bibliography of reports concerning the Search for Extraterrestrial Intelligence is presented. Cosmic evolution, space communication, and technological advances are discussed along with search strategies and search systems. J.C.S.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N78-18772 Southern Methodist Univ., Dallas, Tex.
CHARACTERIZATION AND DESIGN OF ERROR CORRECTING/DETECTING CODES FOR ASYMMETRIC MEMORIES Ph.D. Thesis
Serban Dan Constantin 1977 154 p
Avail: Univ. Microfilms Order No. 77-28284

Starting from the notion of asymmetric distance, a metric previously found suitable for the ideal binary asymmetric channel, a class of single 1-error correcting codes, the group theoretic codes, is generated and the properties of these codes are thoroughly investigated. The analysis of the information rate of the group theoretic codes shows that these codes possess the highest information rate of all known single 1-error correcting codes for the ideal binary asymmetric channel. The concentrated group theoretic codes, to which the table look-up encoding/decoding method is more efficiently applied than to the group theoretic codes are introduced. A different encoding/decoding technique is discussed for the fixed weight codes and an extension of it is suggested for the group theoretic codes. A family of perfect error detecting codes for the ideal binary asymmetric channel are introduced and their information rates are discussed. Single error-correcting codes for the binary symmetric channel and multiple 1-error correcting codes for the ideal binary asymmetric channel are derived. Dissert. Abstr.

N78-18773 Notre Dame Univ., Ind.
BOUNDS AND TECHNIQUES FOR LINEAR SOURCE CODING Ph.D. Thesis
Teofilo Caldito Ancheta, Jr. 1977 86 p
Avail: Univ. Microfilms Order No. 77-27841

A method of using error correcting codes to obtain data-compression, called syndrome source coding, is developed in which the source sequence is treated as an error pattern whose syndrone forms the compressed data. A universal generalization of syndrome-source-coding is formulated which provides robustly effective, distortionless coding of source ensembles. For the compression of nonbinary sources, a nonbinary to binary pre-mapping is proposed which converts a K-ary sequence in K-1 passes to a concatenation of K-1 binary sequences. A universal generalization of linear source coding is proposed in which the source sequences of some length n are partitioned into M subsets and a different linear mapping is permitted for each subset. A source sequence is encoded, followed by the compressed digits resulting from the linear mapping corresponding to that subset. Dissert. Abstr.

N78-18774# Illinois Univ., Urbana-Champaign. Dept. of Computer Science.
WALSHSTORE: THE APPLICATION OF BURST PROCESSING TO FAIL-SOFT STORAGE SYSTEMS USING WALSH TRANSFORMS Ph.D. Thesis
Ehud Bracha Oct. 1977 80 p refs
(Contract N00014-75-C-0982)
(AD-A047889; UIUCDCS-R-77-878; UILU-ENG-77-1753) Avail: NTIS HC A05/MF A01 CSCL 12/1

WALSHSTORE is concerned with the investigation into the application of orthogonal transforms, e.g., Walsh transforms, to the storage of visual images in a fail-soft manner, i.e., the system can sustain losses but the retrieved image can still be recognized, even if in a degraded form. The application of Burst Processing to various parts in such a system is investigated together with an analysis of the amount of storage and speed of computation that can be achieved. This paper presents the necessary theory and the implementation of the Walsh transformers and the fail-soft storage which were constructed and tested. Additionally, some software simulation results are compared to the actual machine performance. Author (GRA)

N78-18775# Air Force Avionics Lab., Wright-Patterson AFB, Ohio. Advanced Systems Group.
EFFICIENT MULTIPLE PROCESSOR COORDINATION Final Report, Oct. 1974 - Nov. 1976
Bob E. Baker Jul. 1977 159 p refs
(AD-A048195; AFAL-TR-43) Avail: NTIS HC A08/MF A01 CSCL 09/2

The concept of level-structured system organization has received growing acceptance as a computer operating system design technique. This approach treats the hardware of a computing system as the bottom level of a multilevel system which will be built up one level at a time. Each level creates an abstraction of the next lower level by implementing a new virtual machine which provides some feature not previously available. GRA

N78-18776# Oregon Graduate Center for Study and Research, Beaverton.
FIELD ELECTRON AND ION SOURCE RESEARCH FOR HIGH DENSITY INFORMATION STORAGE SYSTEM Interim Technical Report, 15 May - 15 Aug. 1976
L. W. Swanson Wright-Patterson AFB, Ohio AFAL Apr. 1977 88 p refs
(Contract F33615-76-C-1327; AF Proj. 3164)
(AD-A048200; AFAL-TR-77-34; ITR-1) Avail: NTIS HC A05/MF A01 CSCL 09/2

The purpose of this research program is the development of high brightness field emission sources of both ions and electrons by use of field emission phenomena. Fabrication procedures and evaluation of emission characteristics have been examined for lanthanum hexaboride field electron emitters. Field electron emission from a liquid gallium source has also been developed

and examined. Emission occurs in a pulse mode with 50 to 100 A peak currents in 10 nsec pulses. Gas phase field ion emission using hydrogen has been examined using a high pressure source configuration. Current intensities of 0.00005 A per Sr per torr at 77 K were measured. In addition, a preliminary investigation of ion emission from a liquid gallium source has shown that stable currents up to 150 micro A can be obtained. Author (GRA)

N78-18777# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AUTOMATIC GENERATION OF SEGMENTATION DIRECTIVES ON THE CDC 6600 COMPUTER M.S. Thesis
Steven R. Sarner Dec. 1977 111 p refs
(AD-A047782; AFIT-GCS/MA/77D-4) Avail: NTIS
HC A06/MF A01 CSCL 09/2

Central memory is a critical resource on the Aeronautical Systems Division CDC 6600 computer system. This is especially true in the time-sharing environment where the standard maximum field length for a user's program is 60,000 to-the-base-8 words of central memory. The amount of central memory required to load and execute a program may be reduced by using the CDC segmentation scheme in which a tree structure of relocatable object modules is specified which permits sharing of central memory. However, the design of an effective tree structure for segmenting a large application program can be very difficult and time consuming. This thesis develops a software processor called SEGMENT that automatically generates segmentation directives for a user's program that describe a tree structure for that program. SEGMENT uses a depth-first search to determine the uses algorithms which correctly position labeled common blocks in this tree structure and which eliminate data preset errors and indirect references to externals. GRA

N78-18778# Stanford Univ., Calif. Dept of Computer Science.
HARDWARE VERIFICATION Ph.D. Thesis
Todd Jeffry Wagner Sep. 1977 105 p refs
(Contract MDA903-76-C-0206; ARPA Order 2494)
(AD-A048684; STAN-CS-77-632; AI-M-304) Avail: NTIS
HC A06/MF A01 CSCL 09/2

Methods for detecting logical errors in computer hardware designs using symbolic manipulation instead of digital simulation are discussed. A non-procedural register transfer language is proposed that is suitable for describing how a digital circuit should perform. This language can also be used to describe each of the components used in the design. Transformations are presented which should enable the designer to either prove or disprove that the set of interconnected components correctly satisfy the specifications for the overall system. The problem of detecting timing anomalies such as races, hazards, and oscillations is addressed. Also explored are some interesting relationships between the problems of hardware verification and program verification. Finally, the results of using an existing proof checking program on some digital circuits are presented. Although the theorem proving approach is not very efficient for simple circuits, it becomes increasingly attractive as circuits become more complex. This is because the theorem proving approach can use complicated component specifications without reducing them to the gate level. Author (GRA)

N78-18779# Federal COBOL Compiler Testing Service, Washington, D. C.
COBOL COMPILER VALIDATION Summary Report
6 Jan. 1978 70 p
(AD-A048319; CCVS74-VSR275) Avail: NTIS
HC A04/MF A01 CSCL 09/2

This Validation Summary Report (VSR) for the CDC Cyber COBOL Compiler Version 5.1 RL 460(NOS/BE Version 1.2) provides a consolidated summary of the results obtained from the validation of the subject compiler against the 1974 COBOL Standard (X3.23-1974/FIPS PUB 21-1). The compiler was validated at the high level of FIPS PUB 21-1. The VSR is made up of several sections showing the discrepancies found. These include an overview of the validation which lists all categories of discrepancies by level/module within X3.23-19, a section relating the categories of discrepancies to each of the Federal levels of the language; and a detailed listing of discrepancies together with the tests which were failed. Author (GRA)

N78-18780# Federal COBOL Compiler Testing Service, Washington, D. C.
FORTRAN COMPILER VALIDATION Summary Report
30 Dec. 1977 19 p
(AD-A048317; FCVS66-VSR265) Avail: NTIS
HC A02/MF A01 CSCL 09/2

This Validation Summary Report (VSR) for the IBM 370 series G1 FORTRAN Compiler Version 2.0 (MVS Version 3.7, JES 2) provides a consolidated summary of the results obtained from the validation of the subject compiler against the 1966 FORTRAN Standard (X3.9-1966). The VSR is made up of several sections showing the discrepancies found. These include an overview of the validation which lists all categories of discrepancies; a section relating the categories of discrepancies to the language; and a detailed listing of discrepancies together with the tests which were failed. Author (GRA)

N78-18781# Federal COBOL Compiler Testing Service, Washington, D. C.
FORTRAN COMPILER VALIDATION Summary Report
30 Dec. 1977 18 p
(AD-A048353; FCVS66-VSR260) Avail: NTIS
HC A02/MF A01 CSCL 09/2

This Validation Summary Report (VSR) for the IBM 370 series H Extended FORTRAN Compiler Version 2.2 (MVS Version 3.7, JES 2) provides a consolidated summary of the results obtained from the validation of the subject compiler against the 1966 FORTRAN Standard (X3.9-1966). The VSR is made up of several sections showing the discrepancies found. These include an overview of the validation which lists all categories of discrepancies; a section relating the categories of discrepancies to the language; and a detailed listing of discrepancies together with the tests which were failed. Author (GRA)

N78-18782# Massachusetts Inst. of Tech., Cambridge. Center for Information Systems Research.
AN EXERCISE IN SOFTWARE ARCHITECTURAL DESIGN: FROM REQUIREMENTS TO DESIGN PROBLEM STRUCTURE
Rafael C. Andreu and Stuart E. Madnick Nov. 1977 129 p refs
(Contract N00039-77-C-0255)
(AD-A048765; CISR-P010-01-05; CSIR-TR-3) Avail: NTIS
HC A07/MF A01 CSCL 09/2

Two of the main activities required for the application of the methodology explored in this project, namely, the assessment of design interdependencies among requirements and the interpretation of subsets of requirements as design subproblems, are investigated in the context of a concrete design problem. Guidelines for carrying out these activities are introduced and their usage illustrated. A design framework for the problem analyzed is identified and discussed; its study points out that the methodology investigated here produces interesting and unforeseen results. Author (GRA)

N78-18783# Massachusetts Inst. of Tech., Cambridge. Lab for Computer Science.
SIMULATION OF PACKET COMMUNICATION ARCHITECTURE
Randal Everitt Bryant Nov. 1977 123 p
(Contract N00014-75-C-0661; Contract NSF-DCR-75-04060)
(AD-A048290; MIT-LCS-TR-188) Avail: NTIS
HC A06/MF A01 CSCL 09/2

Simulations of computer systems have traditionally been performed on a single, sequential computer, even if the system to be simulated contains a number of components which operate concurrently. An alternative would be to simulate these systems on a network of processors. With this approach, each processor would simulate one component of the system, hence the component simulations could proceed concurrently. By exploiting the modularity and concurrency in the system to be simulated, the simulation would itself be modular and concurrent. An accurate simulation must model the time behavior of the system as well as its input-output behavior. In order to avoid real-time constraints on the processors and communication network in the simulation

facility, the simulation of the timing must use a time-independent algorithm. That is, the simulated behavior of each component should not depend on the speed at which the simulation is performed. With this time-independent approach, additional coordination operations are required to prevent a deadlock of the simulation. This coordination can be provided without any centralized control. Instead, the program for the simulation of each component is modified, so that each component simulation will communicate status information to other component simulations. Additional termination operations are also required to assure that the simulation will terminate under the exact same conditions that the system being simulated would terminate. These operations can also be provided without any centralization of control or real-time constraints. Furthermore, a simulation which uses these coordination and termination operations is probably correct. GRA

N78-18784# PRC Data Services, Inc., McLean, Va.
WORLD WIDE DATA MANAGEMENT SYSTEM (WWDMS) SELF INSTRUCTION MANUAL, T-2 VERSION, ADDENDUM B Final Report, Dec. 1975 - Sep. 1976
Ronald A. Kogan 30 Sep. 1977 69 p refs
(Contract DCA100-73-C-0015)
(AD-A048478; PRC/DSC-606-Add-B) Avail: NTIS HC A04/MF A01 CSCL 09/2

The purpose of the basic self instruction manual is to allow a person without prior experience in programming languages or data management systems to learn to use the Worldwide Data Management System (WWDMS) as implemented on the Honeywell Series 6000 computer. The first section consists of elementary concepts and represents a stand-alone elementary user's self instruction manual. The second section contains advanced concepts, and when used in conjunction with the first section, comprises a complete advanced WWDMS user's self instruction manual. Author (GRA)

N78-18785# National Bureau of Standards, Washington, D. C. Inst. for Basic Standards.
FOUR VERSATILE MIDAS COMPATIBLE MODULES
Michael A. Lind and Joel B. Fowler Nov. 1977 38 p
(PB-274453/0; NBS-TN-958) Avail: NTIS HC A03/MF A01 CSCL 14B

Several versatile MIDAS compatible modules are documented. These modules include a precision digital to analog converter, a programmable up/down counter, a high speed stepping motor indexer, and an amplifier controller-filter V/F converter. GRA

N78-18786# National Physical Lab., Teddington (England).
THE DIAGNOSTIC FACILITIES IN ALGOL AND FORTRAN COMPILERS
R. S. Scowen Jul. 1977 45 p refs
(NPL-NAC-81) Avail: NTIS HC A03/MF A01

A number of small programs which test the diagnostics facilities available in ALGOL and FORTRAN compilers are presented. Results of running these programs on different computers are given. ESA

N78-18787# Wisconsin Univ., Madison. Dept. of Electrical and Computer Engineering.
THE FILTERING OF IMAGES USING A NEW FIDELITY CRITERION Interim Report
Kelly A. Miller Jul. 1977 78 p refs
(Grant NSF ENG-75-10545)
(PB-274532/1; ECE-77-7) Avail: NTIS HC A05/MF A01 CSCL 09B

A new error criterion for image processing was derived from a parallel, spatial channel model of the human visual system. The new error criterion was compared to the common squared intensity error criterion in optimal linear filtering of images in additive noise. There was slight improvement in filtering using the new criterion. GRA

N78-18788# Wisconsin Univ., Madison. Dept. of Electrical and Computer Engineering.
QUANTIZATION OF IMAGE TRANSFORMS WITH MINIMUM DISTORTION Final Report
George H. Senge May 1977 45 p refs
(Grant NSF ENG-75-10545)
(PB-274533/9; ECE-77-8) Avail: NTIS HC A03/MF A01 CSCL 09B

In computer holography and image processing there is often a need to quantize a complex Gaussian random variable by magnitude and phase angle. But there has not yet appeared in publication the exact minimum mean squared error range and quantization levels for the Rayleigh magnitude distribution. A numerical solution is given for these levels which is very fast and accurate. The levels and distortion are listed as a function of the number of levels for the Rayleigh distribution. The algorithm can be used for quantizing a random variable of any arbitrary distribution. GRA

N78-19032*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
AN APPLICATION OF INTERACTIVE COMPUTER GRAPHICS TECHNOLOGY TO THE DESIGN OF DISPERSAL MECHANISMS
B. J. Richter and B. H. Welch *In* NASA. Goddard Res. Center The 11th Aerospace Mech. Symp. Apr. 1977 p 57-66 (For availability see N78-19026 09-99)
Avail: NTIS HC A11/MF A01 CSCL 09B

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N78-18789 California Univ., Irvine.
INDUCTIVE EXTRAPOLATION: A SYSTEM FOR PROGRAM SYNTHESIS FROM EXEMPLARY DATA EMPLOYING REGULAR GRAMMAR INFERENCE AND POLYNOMIAL SEPARATION OF MACHINE STATES Ph.D. Thesis
Ronald William Colman 1976 194 p
Avail: Univ. Microfilms Order No. 77-30023

The problem of inducing programs from a sample of input/output pairs was studied. The method of solution utilizes a heuristic search, deductive generation, or a human trainer to obtain execution traces for the program to be inferred. A grammar inference process was employed to induce a grammar generating these execution traces. Polynomial training methods were employed to associate with the non-terminals of the grammar, a control mechanism based upon polynomial separation of the sets of machine states associated with each decision point. Convergence was proven for the program inference process. The proof of convergence by approach, was established upon the premise that the set of execution traces in the training set could be represented as traces of a flowchart satisfying certain general criteria. Dissert. Abstr.

N78-18790 Yale Univ., New Haven, Conn.
THE PROCESS OF QUESTION ANSWERING Ph.D. Thesis
Wendy Grace Lehnert 1977 486 p
Avail: Univ. Microfilms Order No. 77-28146

Problems in computational question answering assume a new perspective when question answering is viewed as a problem in natural language processing. A theory of question answering is proposed for this viewpoint which relies on ideas in conceptual information processing and theories answering has been implemented in a computer program, QUALM. QUALM is used by two story understading systems (SAM and PAM) to complete a natural language processing system which reads stories and answers question about what was read. The processes in QUALM are divided into four phases: (1) Conceptual Categorization, (2) Inferential Analysis, (3) Content Specification, and (4) Retrieval Heuristics. Dissert. Abstr.

N78-18791 Catholic Univ. of America, Washington, D. C.
AN INVESTIGATION OF THE BEARING ACCURACY OF TWO PASSIVE MULTI-CHANNEL ARRAY ALGORITHMS IN THE PRESENCE OF CORRELATED NOISE Ph.D. Thesis
James Hetler Witt 1977 176 p
Avail: Univ. Microfilms Order No. 77-27789

The results and findings of an analytic and experimental simulation investigation of the bearing accuracy of two passive

multi-channel array processing algorithms in the presence of uncorrelated and correlated noise. Expressions are derived for the processors' outputs, output means, and output covariances as a function of the array steering angle, beam position, and other key parameters such as array size, signal-to-noise ratio, target bearing, and degree of noise correlation. Several bearing accuracy measures are defined and developed. The impact of increasing noise correlation on the cited outputs and accuracy measures is assessed for each algorithm. The comparative bearing performance of the two algorithms is evaluated and possible areas of trade-offs identified. Recommendations for further investigations are also presented. Dissert. Abstr.

N78-18792 Texas Univ., Austin.
THE ANALYSIS AND SYNTHESIS OF SOME ADVANCED TECHNIQUES FOR DIGITAL SIMULATION Ph.D. Thesis
Yu-Huei Jea 1977 249 p
Avail: Univ. Microfilms Order No. 77-29048

Digital simulation is a mandatory tool in most of today's design automation systems. This work presents a study of advanced techniques used in design of a digital simulator which is cost-effective, accurate, and ease-of-use. Various Boolean vector algebraic structures have been defined and the associated properties have been found out. Other techniques are discussed such as table look-up, switching theory approach, and relational approach. Signal and gate modeling have been studied. A very accurate timing analysis algorithm in five-value precise delay model has been proposed and validated. A modified postfix notation has been suggested to provide a convenient input language for a user-oriented system. Dissert. Abstr.

N78-18793 Oregon State Univ., Corvallis.
A NEW COMPUTATIONAL METHOD FOR CONSTRAINED NONLINEAR PROGRAMMING Ph.D. Thesis
Surendra Pal Singh Bhatia 1977 85 p
Avail: Univ. Microfilms Order No. 77-29405

A computational method of equality constrained nonlinear programming is developed. Specifically, problems of minimizing a nonlinear objective function subject to constraints is considered. The approach employed is based on the idea of seeking simultaneous satisfaction of the associated necessary conditions and the constraints. The method permits a solution of the constrained problem through a single minimization of an equivalent unconstrained problem, for almost any choice of the associated penalty parameter. To evaluate the effectiveness and efficiency of the new method, its performance is compared with that of Hestenes' Multiplier and Fletcher's Exact Penalty Methods in the computational solution of a number of nonlinear programming examples. The method is shown to have superior convergence properties. Dissert. Abstr.

N78-18794 Kansas Univ., Lawrence.
QUADRATURE APPROXIMATION OF BAYESIAN RECURSIVE COMPUTATIONS AND THE IMPLEMENTATION OF NONLINEAR ESTIMATORS Ph.D. Thesis
Hsiao Chuan Wang 1977 149 p
Avail: Univ. Microfilms Order No. 77-28923

A numerical approach was used in the realization of optimal nonlinear estimators. Quadrature formulas derived from spline interpolation were employed for the approximation of the necessary integration in Bayesian recursive computations. The relation between quadrature formula and its underlying monospline is discussed. If the nodes of the quadrature formula are appropriately located so that the interpolation of the first derivative of integrand function at each node is implied, the quadrature formula is so-called optimal quadrature formula. A numerical method for solving a set of simultaneous nonlinear equations induced from spline interpolation to obtain optimal quadrature formula is given. The errors of quadrature approximation and their propagation in the updating procedures were investigated. Dissert. Abstr.

N78-18795*# National Aeronautics and Space Administration, Washington, D. C.
NUMERICAL METHODS FOR THE STATISTICAL ANALYSIS OF RANDOM PROCESSES BY MEANS OF COMPUTERS
G. F. Telenin and F. V. Podsypanin Feb. 1978 63 p refs Transl. into ENGLISH from Sci. Trans., Inst. of Mech., Moscow State Univ. (Moscow), no. 6, 1970 p 1-48 Sponsored by NASA Transl. by Franklin Book Programs Inc., Cairo, Egypt
(Contract NSF C-724)
(NASA-TT-F-17159) Avail: NTIS HC A04/MF A01 CSCL 09B

The collection described the numerical methods of spectral and correlative analysis of stationary random processes. An expression for the numerical estimation of these characteristics was derived and analyzed. The results of the analysis of model processes of known statistical characteristics were realized on a computer, and the real experimental processes were represented as an extensive graphical information. The practical applicability of the numerical methods was the main purpose of the collection. Author

N78-18796*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A COMPUTER PROGRAM FOR ANALYZING UNRESOLVED MOSSBAUER HYPERFINE SPECTRA
James R. Schiess and Jag J. Singh Feb. 1978 35 p refs
(NASA-TM-78633; L-11957) Avail: NTIS HC A03/MF A01 CSCL 09B

The program for analyzing unresolved Mossbauer hyperfine spectra was written in FORTRAN 4 language for the Control Data CYBER 170 series digital computer system with network operating system 1.1. With the present dimensions, the program requires approximately 36,000 octal locations of core storage. A typical case involving two innermost coordination shells in which the amplitudes and the peak positions of all three components were estimated in 25 iterations requires 30 seconds on CYBER 173. The program was applied to determine the effects of various near neighbor impurity shells on hyperfine fields in dilute FeAl alloys. Author

N78-18797*# Aerospace Corp., El Segundo, Calif. Advanced Programs Div.
FAULT-TOLERANT SOFTWARE FOR AIRCRAFT CONTROL SYSTEMS Final Report, Oct. 1966 - Oct. 1977
1 Feb. 1978 82 p refs
(Contract NAS1-14644)
(NASA-CR-145298; ATR-78(7640)-1) Avail: NTIS HC A05/MF A01 CSCL 09B

Concepts for software to implement real time aircraft control systems on a centralized digital computer were discussed. A fault tolerant software structure employing functionally redundant routines with concurrent error detection was proposed for critical control functions involving safety of flight and landing. A degraded recovery block concept was devised to allow collocation of critical and noncritical software modules within the same control structure. The additional computer resources required to implement the proposed software structure for a representative set of aircraft control functions were discussed. It was estimated that approximately 30 percent more memory space is required to implement the total set of control functions. A reliability model for the fault tolerant software was described and parametric estimates of failure rate were made. Author

N78-18798*# Air Force Geophysics Lab., Hanscom AFB, Mass.
SHORT ARC REDUCTION OF RADAR ALTIMETRY COMPUTER PROGRAM Final Report, Sep. 1975 - Jul. 1977
George Hadgigeorge and Jerry Trotter Jan. 1978 90 p refs
(NASA Order P-57270-G)
(NASA-CR-141434) Avail: NTIS HC A05/MF A01 CSCL 09B

The Air Force Geophysics Laboratory computer program SARRA (Short Arc Reduction of Radar Altimetry) has been used for geoid determination with altimetric observations from the GEOS-3 satellite. An important feature of SARRA is the simultaneous recovery of the orbit parameters and the surface coefficients as defined by covariance function weights. Orbits good to approximately 20 meters are adequate for precise geoid determinations by virtue of the orbital adjustment in the reductions. Altimetric data over a portion of the North Atlantic Ocean have been processed to derive the regional geoid and gravity field. Analyses of altimeter residuals resulting from the short arc adjustment show that the residuals can be used to define the neglected higher order geoidal undulations with high fidelity and continuity. Author

N78-18799# Stanford Univ., Calif. Digital Systems Lab.
COMPUTING IN STORE
John K. Iliffe Jun. 1977 65 p refs
(Contract N00014-75-C-0601)
(AD-A048053; SU-DSL-TN-117) Avail: NTIS HC A04/MF A01 CSCL 09/2

These notes provide an introduction to the class of single-instruction, multiple-data stream computers with the simplest processing elements. Design principles are explained in terms of hypothetical Distributed Processor Arrays, with examples drawn from experimental systems. Emphasis is placed on: (a) minimizing the cost differential when the DPA is compared with conventional main storage, and (b) designing the array control unit to support advanced forms of protection and language implementation. The influence of the DPA on general system design is examined briefly. Author (GRA)

N78-18800# Hughes Aircraft Co., Culver City, Calif. Strategic Systems Div.
RELIABILITY EVALUATION OF PROGRAMMABLE READ-ONLY MEMORIES (PROMs), PART 2 Final Technical Report
K. L. Wong, W. W. Powell, R. L. Long, Jr., T. M. Donnelly, and P. C. McMahan Sep. 1977 152 p refs
(Contract F30602-75-C-0294)
(AD-A048231; HAC-P77-157R-Pt-2; RADC-TR-77-302-Pt-2) Avail: NTIS HC A08/MF A01 CSCL 09/2

The primary objectives of this study were to: (1) assess factors affecting the reliability of three types of Programmable Read-Only Memories (PROMs), namely Polysilicon Fuse, Avalanche-Induced-Migration (AIM) and Nichrome Fuse Technologies, (2) Investigate fusing and associated failure mechanisms and (3) Assess the reliability of these PROM's via a life test. GRA

N78-18801# Clemson Univ., S.C. Dept. of Mathematical Sciences.
GENERAL CONSIDERATIONS ON THE DESIGN OF AN INTERACTIVE SYSTEM FOR DATA ANALYSIS
Robert F. Ling Nov. 1977 16 p refs Presented at the TIMS/ORSA Ann. Meeting, Atlanta, 8 Nov. 1977
(Contract N00014-75-C-0451)
(AD-A048248; N93; TR-269) Avail: NTIS HC A02/MF A01 CSCL 09/2

Among the most important criteria in the design and implementation of an interactive system for data analysis are: data structure, control language, user interface, system versatility, extensibility, and portability. The design of an interactive system, viewed as a sequential consideration of these criteria, is discussed. Author (GRA)

N78-18802# University of Southern Calif., Marina del Rey. Information Sciences Inst.
ON THE USE OF PROGRAMMING KNOWLEDGE TO UNDERSTAND INFORMAL PROCESS DESCRIPTION
Robert Balzer, Neil Goldman, and David Wile Oct. 1977 16 p refs
(Contract DAHC15-72-C-0308; ARPA Order 2223)
(AD-A048153; ISI/RR-77-63) Avail: NTIS HC A02/MF A01 CSCL 09/2

The goal of improving and simplifying communication with computers has been pursued largely through the creation and use of better formal languages. This report investigates an alternative approach by exploring the variety and extent of informal constructs which can be introduced into a formal language without impairing communication. These informal constructs represent the suppression of certain explicit information which must be inferred from the surrounding context. In general, each informal construct has several possible interpretations, only one of which was intended by the speaker. The system's task is to use the existing context to focus attention on a small ordered subset of the most probable alternatives and to further reduce it by applying any constraints or well-formedness rules. The most probable remaining alternative is selected as the intended one. Program descriptions were chosen as the example task domain to test this approach because its rules of context and well-formedness are fairly well developed. GRA

N78-18803# Clemson Univ., S.C. Dept. of Mathematical Sciences.
CONSTRAINTS IN THE DESIGN AND IMPLEMENTATION OF INTERACTIVE STATISTICAL SYSTEMS FOR MINICOMPUTERS
Robert F. Ling May 1977 19 p refs
(Contract N00014-75-C-0457)
(AD-A048124; N84; TR-251) Avail: NTIS HC A02/MF A01 CSCL 09/2

In this paper, attention is focussed on issues and problems relating to the design and implementation of interactive statistical systems (as opposed to batch systems or small batch or interactive programs) for mini-computers. In particular, constraints imposed by certain characteristics of existing mini-computers (such as size of main storage and data format) as well as related operating systems software and programming languages are discussed. Efforts to relax or eliminate these constraints may be considered as prospects for statistical systems for future generations of mini-computers. Author (GRA)

N78-18804# Texas Univ., Austin. Center for Cybernetic Studies.
NETWORK VERSUS LINEAR PROGRAMMING ALGORITHMS AND IMPLEMENTATIONS
Fred Glover (Colo. State Univ.), John Hultz (Analysis, Res., and Computation, Inc.), and Darwin Klingman Sep. 1977 31 p refs
(Contract N00014-75-C-0616; N00014-75-C-0569; NR Proj. 047-021)
(AD-A048296; CCS-306) Avail: NTIS HC A03/MF A01 CSCL 09/2

Over the years modelers and practitioners have become so adept at designing large scale linear programming problems that in some cases the complexity is staggering. This has led to a demand for alternative design and solution procedures. Noting that the vast majority of linear programming problems contain at least some embedded network structure, researchers in the network area have made many advances in the past few years. This paper provides insights as to why network techniques are having such a large impact on modelers and why network solution procedures are being selected over standard linear programming systems for use in many real world applications. As dramatic proof of the savings offered by network solution procedures, various network computer codes are compared with the standard linear programming system APEX-III. Results indicate that the network techniques are 200 times faster on highly structured problems and as much as 25 times faster on more complex embedded network problems. GRA

N78-18805# Texas Univ., Austin. Center for Cybernetic Studies.
AN EVALUATION OF MATHEMATICAL PROGRAMMING AND MINICOMPUTERS
Joyce Elam (Pa. Univ.), Darwin Klingman, and John Mulvey (Harvard Univ.) Oct. 1977 24 p refs Prepared in cooperation with Decision Analysis and Res. Inst., Austin, Tex.
(Contracts N00014-76-C-0616; N00014-75-C-0569; N00014-76-C-0383; DOT-OS-70074; NR Proj. 047-021)
(AD-A048299; CCS-313) Avail: NTIS HC A02/MF A01 CSCL 09/2

The purpose of this paper is to explore the viability of implementing mathematical programming algorithms on minicomputers. We feel that the minicomputer explosion presents many exciting research challenges in terms of both identifying and matching appropriate algorithms and applications for such hardware. This paper partially examines these issues by comparing the computational performance of two shortest path algorithms on four very distinct types of computer hardware. Author (GRA)

N78-18806# Mitre Corp., Bedford, Mass.
DESIGN AND ABSTRACT SPECIFICATION OF A MULTICS SECURITY KERNEL, VOLUME 1
W. L. Schiller Nov. 1977 60 p refs
(Contract F19628-77-C-0001)
(AD-A048576; MTR-3294-Vol-1; ESD-TR-77-259-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 17/2

On the basis of the recommendations of the ESD Computer Security Technology Panel techniques were developed for the

design, implementation, and formal mathematical verification of a security kernel (a hardware and software mechanism to control access to information within a computer system). This three-volume report describes the design of a security kernel for the Honeywell Information Systems Multics computer system. This first volume gives a methodology and design overview. The primary subsystems are defined, and the reasoning behind the design decisions is given. The correspondence of the design to a mathematical model is discussed, giving a preview to the formal verification. The second volume gives a formal top-level specification of the primary subsystems. The third volume deals with the secondary subsystems, including the issues of initialization and reconfiguration. GRA

N78-18807# System Development Corp., Santa Monica, Calif.
SOFTWARE ACQUISITION MANAGEMENT GUIDEBOOK: VERIFICATION
Harvey Bratman and Marcia C. Finfer Aug. 1977 73 p refs
(Contract F19628-76-C-0236)
(AD-A048577; SDC-TM-5772/002/02; ESD-TR-77-263) Avail: NTIS HC A04/MF A01 CSCL 09/2

This report is one of a series of Software Acquisition Management Guidebooks which provide information and guidance for ESD Program Office personnel who are charged with planning and managing the acquisition of command, control, and communications system software procured under Air Force 800 series regulations and related software acquisition management concepts. It provides a review of the software verification practices and procedures employed by industry and set forth in relevant DoD and Air Force regulations, specifications, and standards. It specifically: defines verification; describes the software related planning system engineering, and testing activities, carried out by the Program Office and the contractor, which lead to Computer Program Configuration Item (CPCI) verification; and references specific software techniques and tools required to CPCI verification. Author (GRA)

N78-18808# Stanford Univ., Calif. Digital Systems Lab.
VERIFYING CONCURRENT PROGRAMS WITH SHARED DATA CLASSES
Susan Owicki Aug. 1977 32 p refs
(Contract N00014-75-C-060123)
(AD-A048637; DSL-TR-147) Avail: NTIS HC A03/MF A01 CSCL 09/2

Monitors are a valuable tool for organizing operations on shared data in concurrent programs. In some cases, however, the mutually exclusive procedure calls provided by monitors are overly restrictive. Such applications can be programmed using shared classes, which do not enforce mutual exclusion. This paper presents a method of verifying parallel programs containing shared classes. One first proves that each class procedure performs correctly when executed by itself, then shows that simultaneous execution of other class procedures can not interfere with its correct operation. Once a class has been verified, calls to its procedures may be treated as uninterruptible actions; this simplifies the proof of higher-level program components. Proof rules for classes and procedure calls are given in Hoare's axiomatic style. Several examples are verified, including two versions of the readers' and writers' problem and a dynamic resource allocator. Author (GRA)

N78-18809# National Physical Lab., Teddington (England). Div. of Computer Science.
AN INTRODUCTION TO NETWORK JOB CONTROL LANGUAGE
D. Rayner Mar. 1977 17 p refs Sponsored by Computer Systems and Electron. Requirements Board
(NPL-Com-88) Avail: NTIS HC A02/MF A01

A definition of the functions of a network job control language is given. Four interrelated aspects are identified, namely: to provide a network standard high level system independent job control language for batch and interactive use; to provide access to various databases in a uniform way; to provide simple user interface; and to enable users to perform distributed computing either in sequential mode or with some degree of synchronized parallelism. These aspects are discussed individually. A project entitled Network Control Facility, designed to study one of these areas in particular, is outlined. Author (ESA)

N78-18810# International Institute for Applied Systems Analysis, Laxenburg (Austria).
ON THE USE OF MATRIX FACTORIZATION TECHNIQUES IN PENALTY FUNCTION METHODS FOR STRUCTURED LINEAR PROGRAMS
Spartak Chebotarev May 1977 30 p refs
(IIASA-RM-77-21) Avail: NTIS HC A03/MF A01

An algorithm converging to an optimal solution of a linear program in a finite number of steps is proposed. The algorithm is based on the use of smooth penalty functions as well as on matrix factorization techniques. It consists of finding corner points of the piece-wise linear unconstrained minima trajectory. The application of the algorithm to dynamic linear programs and block-angular programs is described. Author (ESA)

N78-18811# National Bureau of Standards, Washington, D. C. Inst. for Basic Standards.
FORTRAN PROGRAM TO DETERMINE LENGTH OF GAGE BLOCKS USING SINGLE WAVELENGTH INTERFEROMETRY
Ruth N. Varner Sep. 1977 55 p refs
(PB-274895/2; NBS-TN-956) Avail: NTIS HC A04/MF A01 CSCL 09B

A description of a computer program which computes the length of a gage block from a process using single wavelength interferometry was given. The computer program was written in American National Standards Institute FORTRAN, with emphasis on making it as machine independent as possible. A sample of input and output was provided. GRA

62 COMPUTER SYSTEMS

Includes computer networks.

N78-18812 Oregon Univ., Eugene.
A DISTRIBUTED HIERARCHICAL COMPUTER SYSTEM FOR LABORATORY AUTOMATION Ph.D. Thesis
Arbron Randall Heap 1977 130 p
Avail: Univ. Microfilms Order No. 77-26444

The network allows data to be collected by a small computer directly connected to an experiment, which then passes the data on through a network communications system to another, larger computer. The second computer may save the data or process it and return control information back to the first computer, allowing computer feedback controlled experiments. High speed communications allow realtime data acquisition and feedback control. A real time monitor was implemented to allow multitasking using priority scheduling. Tasks can be created, executed and terminated under control of the monitor with memory management routines to control the utilization of computer memory. Control data can be passed between tasks using either a semaphore system or queues. Dissert. Abstr.

N78-18813 Tennessee Univ., Knoxville.
THEORY OF TEARING AND ITS APPLICATION TO LARGE-SCALE SYSTEMS Ph.D. Thesis
Min-Hwan Kao 1977 178 p
Avail: Univ. Microfilms Order No. 77-27672

New methods and algorithms which require much less formulation work, computer storage, and computation time for the solution of large scale network systems were obtained. The advantages of using the tearing methods for system analysis are demonstrated. Further results were obtained to extend the capability of the tearing methods from the single level, steady state analysis of linear networks to the multi-level, transient analysis of nonlinear networks. Application to the area of computer-aided analysis/design of large scale network systems is also proposed. Dissert. Abstr.

N78-18814# Texas Univ., Austin. Center for Cybernetics Studies.
GENERALIZED NETWORKS: A FUNDAMENTAL COMPUTER-BASED PLANNING TOOL
Fred Glover (Colo. State Univ.), John Hultz (Analysis, Res. and Computation, Inc.), Darwin Klingman, and J. Stutz Jun. 1977 37 p refs Prepared in Cooperation with Decision Analysis and

Res. Inst., Austin, Tex.
(Contract N00014-75-C-0616; N00014-75-C-0569; N00014-76-C-0383)
(AD-A048297; CCS-307) Avail: NTIS HC A03/MF A01 CSCL 09/2

This paper documents the recent emergence of generalized networks as a fundamental computer-based planning tool and demonstrates the power of the associated modeling and solution techniques when used together to solve real-world problems. Part I of the paper is a non-technical account of how generalized networks are used to model a diversity of significant practical problems. Part II is a technical exposition of the design and analysis of computer solution techniques for large-scale GN problems. It contains a study of GN solution strategies within the framework of specializations of the primal simplex method. The resulting computer code is shown on large problems to be at least 50 times more efficient than the LP system, APEX III. The computer memory requirements of our method, as well as the solution times, are sufficiently small to warrant its use as a computer-based planning tool not only in a batch processing environment, but also in an interactive setting. GRA

N78-18815# Central Electricity Research Labs., Leatherhead (England).
THE DECISION TABLE APPROACH TO RELIABLE SOFTWARE
E. I. Hogger Jul. 1977 10 p refs Presented at the IAEA/Westinghouse Conf. on Software Reliability, Pittsburgh, 20-22 Jul. 1977
Avail: NTIS HC A02/MF A01

Software reliability in the context of computerized control and instrumentation systems is discussed. Formal methods for the proof of program correctness are presented. A large proportion of serious software failures are due to errors in design specification and implementation. Investigations were concentrated on the use of decision tables. The computer facilities developed to allow maximum use of the advantages of decision tables are discussed. Two examples of sequence control using decision tables are given. ESA

N78-18816# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
MODULAR MULTICOMPUTER SYSTEMS WITH MINI- AND MICROPROCESSORS. MILITARY APPLICABILITY AND RESEARCH ACTIVITIES [MODULARE MULTICOMPUTERSYSTEME MIT MINI- UND MIKROPROZESSOREN. WEHRTECHNISCHE VERWENDBARKEIT UND FORSCHUNGSAKTIVITAETEN]
H. Vonlssendorff Sep. 1976 27 p In GERMAN; ENGLISH summary
(FFM-246) Avail: NTIS HC A03/MF A01

Mini- and microprocessors are very well suited for designing application-adapted multicomputer systems, which can be employed in all areas of military control. The advantages of such modular systems are analyzed, research problems to be solved are mentioned, and some possible applications are described. Author (ESA)

N78-18817# National Physical Lab., Teddington (England). Div. of Computer Science.
PROBLEMS IN DESIGNING A HIGH-SPEED LINEAR DATA BUS FOR A MULTIMICROPROCESSOR SYSTEM
P. T. Neale Jan. 1977 29 p refs Sponsored by Computer Systems and Electron. Requirements Board
(NPL-Com-89) Avail: NTIS HC A03/MF A01

The fundamental problems in designing a parallel, high-speed, high-capacity linear data bus acting as a link between a large number of computer processors are analyzed. In the system so formed it is assumed that all processors and any other devices allowed to use the bus are sited within a few feet of each other. Use of microprocessor units is implied. Results from both theoretical study and a simple prototype indicate that the physical structure of the bus is a crucial factor in determining the average data throughput of such a system. At the kinds of data rates considered (about 5 - 10 Mbits/sec per signal line), the effects on throughput due to the propagation delays introduced by the length of the bus become significant. The larger the number of processors (or processors and store modules) using a single bus, the longer the bus must be. Thus, as more processors are added to the system, the average usable bandwidth of the bus decreases. Optimized linear bus structures and methods for data transfer can be developed to minimize this problem. Author (ESA)

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

N78-18818 Virginia Univ., Charlottesville.
SOME APPLICATIONS OF DISCRETE ANALOG SIGNAL PROCESSING TO PATTERN RECOGNITION Ph.D. Thesis
Robert Bangel Scher 1977 202 p
Avail: Univ. Microfilms Order No. 77-28636

The results of a study of potential applications of discrete analog signal processing technology to automtic pattern recognition are presented. The basic characteristics of discrete analog devices, in particular, of charge transfer devices, are reviewed, and a simple model for the effect of charge transfer inefficiency is derived. Discrete analog processor architectures for implementing selected computational and decision procedures are developed and analyzed; these procedures include linear pattern classification and two-dimensional image filtering, template matching, and autocorrelating. A processor is described which is capable of computing a programmable sequence of linear transversal filter functions. Results of design tradeoff studies and of tests performed with the hardware breadboard are given. Dissert. Abstr.

N78-18819 Louisiana State Univ. and A&M Coll., Baton Rouge.
APPLICATIONS OF PATTERN RECOGNITION AND LEARNING CONTROLLERS TO POWER SYSTEM ANALYSIS AND CONTROL Ph.D. Thesis
Ronald Jerry LaCarna 1977 128 p
Avail: Univ. Microfilms Order No. 77-28686

A learning controller using an interpolation technique and initially trained by an optimal feedback gain matrix (teacher) was used to control the response of a 2 area interconnected power system. The system was subjected to step load disturbances and to a variation in the system tie-line constant. The learning controller successfully adapted to these disturbances. The problem of optimal rescheduling of generation and demand to maintain security of a power system network was reformulated as a pattern recognition problem and a search technique used to solve for the optimal reschedule based on a cost function that included all equality and inequality constraints. The method proved to be simpler than the usual linear programming approach. The feasibility of using pattern recognition and learning alogorithms to solve problems in power system analysis and control was demonstrated. Dissert. Abstr.

N78-18820 Mississippi State Univ., State College.
COMPENSATOR IMPROVEMENT FOR MULTIVARIABLE CONTROL SYSTEMS Ph.D. Thesis
Lennor Lynn Gresham 1977 156 p
Avail: Univ. Microfilms Order No. 77-28547

The theory and associated numerical technique for the iterative design improvement of the compensation for linear, time-invariant control systems with multiple inputs and multiple outputs are developed. The multicariable capabilities allow system suboptimization of several control loops with coupled characteristics. A strict constraint algorithm is used in obtaining a solution to the specified contraints of the control design. The result of the research effort is the Multiple Input, Multiple Output Compensator Improvement Program (CIP). The underlying principles of the multivariable CIP algorithm are presented and the practical utility of the program is illustrated with space-vehicle related examples. The capabilities of and possible extension to the algorithm are delineated. Dissert. Abstr.

N78-18821 California Univ., Los Angeles.
PERIODIC OPTIMIZATION AND CONTROLLABILITY OF PERIODIC CONTROL SYSTEMS Ph.D. Thesis
Larry Eugene Miller 1977 124 p

Avail: Univ. Microfilms Order No. 77-30942

Analogous to the classical control problem, a concept of periodic controllability (i.e., controllability using periodic controls with corresponding periodic trajectories) for the periodic control system is defined. The thesis contains results on periodic controllability of both linear and nonlinear systems. The thesis focuses attention to the problem of periodic optimization. Two objectives in this thesis are: (1) to show that the set of admissible pairs (x,u) are non-empty, and (2) to show the existence of an optimal admissible pair. Results for both are given.

Dissert. Abstr.

N78-18822*# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.

THE DISCRETE-TIME COMPENSATED KALMAN FILTER

Wing-Hong Lee and Michael Athans Feb. 1978 42 p refs (Grant NsG-1312)

(NASA-CR-2916) Avail: NTIS HC A03/MF A01 CSCL 09B

A suboptimal dynamic compensator to be used in conjunction with the ordinary discrete time Kalman filter was derived. The resultant compensated Kalman Filter has the property that steady state bias estimation errors, resulting from modelling errors, were eliminated. Author

N78-18823*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EIGENVALUE/EIGENVECTOR ASSIGNMENT USING OUTPUT FEEDBACK

S. Srinathkumar Feb. 1978 32 p refs

(NASA-TP-1118; L-11869) Avail: NTIS HC A03/MF A01 CSCL 09B

The problem of eigenvalue assignment in a linear time-invariant system using output feedback is considered. New sufficient conditions are derived to assign an almost arbitrary set of minimum (n,m + r - 1) distinct eigenvalues where n, m, and r are the number of states, inputs, and outputs, respectively. These conditions precisely identify the class of systems where such an assignment is impossible. The synthesis technique also highlights the freedom in selection of closed-loop eigenvectors under output feedback. The utility of eigenvalue/eigenvector assignment in transient response shaping is illustrated by the design of a controller for the lateral dynamics of an aircraft.

Author

N78-18824# Pattern Analysis and Recognition Corp., Rome, N. Y.

APPLICATIONS PROGRAMS FOR THE WAVEFORM PROCESSING SYSTEM Final Report

Charles J. Berster Griffiss AFB, N. Y. RADC Nov. 1977 23 p Addendum to RADC-TR-76-224-Vol-1; RADC-TR-76-224-Vol-2;RADC-TR-76-224-Vol-3

(Contracts F30602-76-C-0373; F30602-72-C-0193; AF Proj. 5597)

(AD-A048208; PAR-77-27; RADC-TR-77-349; RADC-TR-76-224-Vol-1; RADC-TR-76-224-Vol-2; RADC-TR-76-224-Vol-3) Avail: NTIS HC A02/MF A01 CSCL 09/2

Many new options were added to the system, along with enhancements which resulted in a more flexible and reliable pattern recognition tool. This is an addendum to the WPS final report which is in four volumes. Volume I is the technical report, Volume II is the user's manual, Volume III is the technical report and user's manual for PARLAN, the language developed for WPS, and Volume IV is the software documentation. GRA

N78-18825# University of Southern Calif., Marina del Rey. Information Sciences Inst.

THE INFERENCE OF DOMAIN STRUCTURE FROM INFORMAL PROCESS DESCRIPTIONS

Neil Goldman, Robert Balzer, and David Wile Oct. 1977 26 p refs

(Contract DAHC15-72-C-0308; ARPA Order 2223)

(AD-A048154; ISI/RR-77-64) Avail: NTIS HC A03/MF A01 CSCL 09/2

Understanding informal descriptions of processes requires access to a body of knowledge about the process domain, and the ability to use that knowledge appropriately. A great deal of effort has been spent in developing methods for organizing and using domain knowledge; relatively little has been done to automate acquisition of such knowledge. Since English process descriptions reflect the underlying structure of the process domain, knowledge about that structure may be inferred from the description itself. A categorization of important structural knowledge classes is presented, and a production system described which interprets English-like statements on the basis of existing structural context. A sample of the rules from this system is examined. By assuming conditions required in the rule patterns when a linguistic structure is not interpretable, it is possible to infer a great deal of structural knowledge about a process domain. This incremental growth of domain structure presents an alternative to constructing process understanding systems applicable only to very restricted domains, or requiring extensive additions of domain-specific knowledge by human experts for each new task. Author (GRA)

N78-18826# Yale Univ., New Haven, Conn. Dept. of Psychology.

DESIGN OF A PRODUCTION SYSTEM FOR COGNITIVE MODELLING NUMBER 1 Technical Report, 1 Jun. - 1 Sep. 1977

John R. Anderson and Paul J. Kline 1 Sep. 1977 38 p refs (Contract N00014-77-C-0242; NR Proj. 154-399; RR0420417; RR0420401)

(AD-A048196; TR-77-2) Avail: NTIS HC A03/MF A01 CSCL 06/4

It has been conjectured that a good cognitive psychology theory will lead to a good artificial intelligence (AI) program. If this is true, there should be a convergence of psychological and AI considerations in theory construction. This convergence is illustrated in terms of ACT, a computer simulation model of cognitive processes. Separate AI and psychological considerations are used to motivate the decision to design ACT as a production system operating on an associative network data base. Similar motivation is provided for other features of ACT implemented within this framework. These features include the use of a propositional structure for the associative network, a spreading activation process operating on the network, the simulated ability to execute several procedures in parallel, and the use of strength measures to select among competing productions and competing paths in the network. GRA

N78-18827# Air Force Systems Command, Wright-Patterson AFB, Ohio.

USE OF THE MA-48L ITERATIVE ANALOG COMPUTER IN CONTROL SYSTEM DESIGNING

Tadeuz Tucholski 6 Jul. 1977 14 p refs Transl. into ENGLISH from Pomiary Automatyka Kontrola (Poland), v. 22, no. 10, 1976 p 369-371

(AD-A048559; FTD-ID(RS)T-1081-77) Avail: NTIS HC A02/MF A01 CSCL 09/2

The author presents the areas of application of the analog iterative computer and its advantage over a classical analog computer. He describes the structure and gives examples of the use of the MA-48L iterative analog computer in control system designing. Author (GRA)

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N78-18828 State Univ. of New York, Stony Brook.

CONVEX RIEMANNIAN MANIFOLDS OF NON-NEGATIVE CURVATURE Ph.D. Thesis

Stephen David Kronwith 1977 60 p

Avail: Univ. Microfilms Order No. 77-25360

In order to study convex sets the notion of a convex manifold was introduced. A manifold of non negative curvature has a complete metric of non negative curvature on its interior. This result was used to discover if a convex manifold of non negative curvature can be isometrically imbedded into a complete, non compact manifold of non negative curvature. The question was answered partially in the general dimension case where the second fundamental form of the boundary is positive definite and the

curvature is positive, and almost completely in the case of convex surfaces, the answer in all these cases being in the affirmative.
Dissert. Abstr.

N78-18829 Oregon State Univ., Corvallis.
HYPOTHESIS TESTING FOR THE PARAMETERS OF A COVARIANCE MATRIX HAVING LINEAR STRUCTURE Ph.D. Thesis
Mohamed Yahia Elbassiouni 1977 92 p
Avail: Univ. Microfilms Order No. 77-25903

The general family of multivariate normal distributions where the mean vector lies in an arbitrary subspace and the covariance matrix sum of theta has a linear structure was considered. When the minimal sufficient statistic was complete, test statistics having optimal properties for testing statistical hypotheses about theta were derived. The important special case where the matrices in the covariance structure commute is emphasized. In this case chi square test and F-tests were obtained. Several examples are worked out to indicate the wide range of applications covered by the investigations. Dissert. Abstr.

N78-18830 Iowa State Univ. of Science and Technology, Ames.
REGRESSION ESTIMATION FOR MULTIVARIATE NORMAL DISTRIBUTIONS Ph.D. Thesis
Grace Ogechukwukanma Esimai 1977 185 p
Avail: Univ. Microfilms Order No. 77-25982

The method of regression estimation is used widely in sample survey. Let the p=1 variates follow a normal distribution (p > or = to 1). In estimating the mean mu of one variable say Y, the investigator may use the remaining p variables, say X, as auxiliary variables to increase precision. If mu sub x, the mean of X, is known, he may use the regression estimator. If mu sub x is completely unknown, he may use the simple mean of y to estimate mu. The general case of p greater than or equal to 1 was considered. The bias, mean square error and relative efficiency of the preliminary test estimator are obtained and discussed for the cases when the covariance matrix, sigma, is known and unknown. Dissert. Abstr.

N78-18831 Minnesota Univ., Minneapolis.
ROBUST DESIGN FOR REGRESSION PROBLEMS Ph.D. Thesis
Lawrence Alcidos Thibodeau 1977 174 p
Avail: Univ. Microfilms Order No. 77-26166

Model robust designs for a specified model space are defined as designs which satisfy a minimax efficiency criteria. The optimality criteria insures a known level of both prediction and estimation efficiency regardless of the model that is selected. Theorems on the invariance and uniqueness of such designs were proven. Algorithms for the generation of model robust designs for finite but arbitrary model spaces are presented. Polynomial model space, were considered in detail. A theorem on the support of model robust designs for polynomial spaces is proved. Additionally designs in a class of easily computable designs were considered as approximations to the corresponding model robust designs. Finally some model robustness properties of the limiting D-optimal polynomial design were considered. Dissert. Abstr.

N78-18832 Mississippi Univ., University.
ALMOST TRACEABLE GRAPHS AND TRACEABILITY Ph.D. Thesis
James Michael Kinney 1977 82 p
Avail: Univ. Microfilms Order No. 77-28961

The purpose of this paper examines the availability of paths in a graph when restrictions on vertices are varied. Particular emphasis is placed on the properties of arbitrarily 1-path covered and arbitrarily 2-path covered graphs. A relationship between the maximum degree of the vertices of a graph and the ability to arbitrarily 2-path cover a graph is discussed for edge saturated graphs. An examination of the properties of almost traceable graphs culminates in a characterization of edge saturate, arbitrarily 2-path covered graphs having connectivity one. A special class of graphs called flip-flops is used to provide counterexamples to conjectures concerning hypoHamiltonian graphs. The traceability of almost traceable graphs of connectivity one is determined for all graphs except those having exactly three blocks.
Dissert. Abstr.

N78-18833 Tennessee Univ., Knoxville.
EFFECTS OF TWO CALCULUS TREATMENTS UPON ACHIEVEMENT AND CRITICAL THINKING ABILITY Ph.D. Thesis
Boris Vasir Marchegiani 1977 142 p
Avail: Univ. Microfilms Order No. 77-27680

One of the two treatments contained a rigorous development of the course content, which deemphasized applications and stressed the logical structure of the material: a proof treatment. The other stressed applications and deemphasized the logical structure of the material: a nonproof treatment. The results of the critical thinking data gathered following the instruction indicated that students of the nonproof treatment performed significantly better than the students in the proof treatment. Furthermore, the nonproof treatment had a significant effect in the improvement of the subjects' critical thinking ability. However, since the statistical power of the tests was low, the hypothesis that there is no significant difference in pre- and posttest means Watson-Glaser Critical Thinking Appraisal scores for the proof treatment were neither rejected nor accepted. Dissert. Abstr.

N78-18834 Wisconsin Univ., Milwaukee.
TOTALLY AND PARTIALLY AMBIGUOUS POINTS OF PLANAR FUNCTIONS Ph.D. Thesis
Ruth Lynn Mikkelson 1977 76 p
Avail: Univ. Microfilms Order No. 77-29610

For a given function f there may be more than one direction of ambiguity at a point p. A point p is a partially ambiguous point of a function f if f has more than one direction as a direction of ambiguity at p. A point p is a totally ambiguous point of a function f if f has every direction as a direction of ambiguity at p. If f belongs to A, then the set of totally ambiguous points of f is denoted T (f). A function was constructed that has the property that at every point of the plane the function has an enumerable number of directions of ambiguity. At each point this enumerable set of directions can be dense. An enumerable set of directions is the most possible in that for a function f the set of points of the plane at which f has unaccountably many directions of ambiguity in a sparse set.
Dissert. Abstr.

N78-18835 Maryland Univ., College Park.
APPROXIMATION BY ALGEBRAIC NUMBERS OF BOUNDED DEGREE Ph.D. Thesis
John Francis Morrison 1977 124 p
Avail: Univ. Microfilms Order No. 77-30531

The approximation of p-adic numbers by algebraic numbers of bounded degree is considered. Theorems in the real case are shown to hold in the p-adic case. Some other results, relating approximation by algebraic numbers to the approximation of zero by linear forms, are proved. In the second part of this thesis the number of solutions to absolute value of beta minus alpha is less than CH times alpha to the minus 3rd power are counted asymptotically, where beta is a fixed cubic irradiational and alpha is algebraic of degree at most 2. An estimate of the smallest constant, for which the number of solutions is infinite, is estimated. Dissert. Abstr.

N78-18836 California Univ., Berkeley.
NUMERICAL EXPERIMENTS CONCERNING THE EIGENVALUES OF THE LAPLACIAN ON A ZOLL SURFACE Ph.D. Thesis
Gerald Raphael Chachere 1977 95 p
Avail: Univ. Microfilms Order No. 77-31312

Numerical evidence is presented for two conjectures concerning the splitting of eigenvalues of Delta, the Laplace-Beltrami operator on S squared the 2-spheres, as Delta is changed to Delta sub eta. A result of Alan Weinstein implied that for a Zoll perturbation Delta sub eta the diameter of the set containing mu(L) and the L-th order cluster was uniformly bounded for all L. Thus, if the conjectures were true, knowledge of the spectrum of Delta sub eta was increased. The evidence which supports the conjectures was generated by output from various computer experiments. Each experiment approximated the eigenvalues of some perturbation of Delta. Dissert. Abstr.

N78-18837 Emory Univ., Atlanta, Ga.
SOME PROBLEMS CONCERNING RESIDUAL FINITENESS

IN ALGEBRAS Ph.D. Thesis
Ronald Francis Garrett 1977 94 p
Avail: Univ. Microfilms Order No. 77-32377

Finite separability problems in free semigroups, free commutative semigroups, the free product of monoids, and free division groupoids is discussed. An algebra was residually finite if for every pair of elements x and y in A there was a homomorphism alpha from A onto a finite algebra such that alpha(x) is not equal to alpha(y). An algebra was finitely separable if for every finitely generated subalgebra S of A and element of x of A which was not in S there was a homomorphism alpha from A onto a finite algebra such that alpha(x) is not in alpha(S). It is well known that free semigroups and free commutative semigroups are residually finite and finitely separable. Results from automata theory were translated into semigroup language which prove that free semigroups are subsemigroup separable. These results described two algorithms for deciding if two finitely generated subsemigroups of a free semigroup have a nonempty intersection. Dissert. Abstr.

N78-18838 Northern Colorado Univ., Greeley.
ALGORITHMIC UNDECIDABILITY Ph.D. Thesis
Ronald Earl Loser 1977 143 p
Avail: Univ. Microfilms Order No. 77-30841

The algorithmic unsolvability of the halting problem for Turing Machines was proven, and is used to demonstrate the unsolvability of the word problem for Thue systems; then algorithmic unsolvability of word problems is given a new characterization in terms of existence of canonical representatives of Thue equivalence classes. This new characterization is applied to prove that there exist finitely presented groups which have no graphs (Cayley diagrams), to prove the undecidability of the group presentation problem, to show that the Solomonoff formal model of scientific induction contains undecidable propositions, and to demonstrate that arbitrary choice functions cannot, in general, be algorithmically computed. The final section of the dissertation is a catalogue of results relating to decidability/undecidability. Dissert. Abstr.

N78-18839 Duke Univ., Durham, N. C.
CORRESPONDENCES AND ADMISSIBLE POLYNOMIALS Ph.D. Thesis
Jo Ann Lutz 1977 120 p
Avail: Univ. Microfilms Order No. 77-31675

Polynomials of special form were examined and their admissibility was characterized. In particular, if h(x,y) is contained in F sub q [x, y] is of the form h(x,y) = f sub 1(X)-g sub 1(Y) + f sub 2(X)g sub 2(Y) where f sub 1, f sub 2, g sub 1, g sub 2 are polynomials with coefficients in F sub q, then conditions for the admissibility of h(x,y) are given. Dissert. Abstr.

N78-18840# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
TEN-PLACE TABLES OF THE VOIGT AND GROWTH FUNCTIONS Final Report, Jun. 1976 - Jul. 1977
Henry E. Fettis and James C. Caslin Aug. 1977 166 p refs
(AF Proj. 7071; AF Proj. 2304)
(AD-A047871; AFFDL-TR-77-86) Avail: NTIS MF A01 CSCL 12/1

The present tables of both functions are accurate to ten or more figures and cover a wider range of the parameters than those published heretofore. GRA

N78-18841# Maryland Univ., College Park.
PERTURBATION BOUNDS FOR THE DEFINITE GENERALIZED EIGENVALUE PROBLEM
G. W. Stewart Oct. 1977 26 p refs
(Contract N00014-76-C-0391)
(AD-A048072; TR-591) Avail: NTIS HC A03/MF A01 CSCL 12/1

It is shown that a definite problem has a complete system of eigenvectors and its eigenvalues are real. Under perturbations of A and B, the eigenvalues behave like the eigenvalues of a Hermitian matrix in the sense that there is a 1-1 pairing of the eigenvalues with the perturbed eigenvalues and a uniform bound for their differences (in this case in the chordal metric). Perturbation bounds are also developed for eigenvectors and eigenspaces. GRA

N78-18842# Clemson Univ., S.C. Dept. of Mathematical Sciences.
APPROXIMATION OF A COMPLETELY MONOTONE FUNCTION
Khursheed Alam and Walter Walker Oct. 1977 11 p refs
(Contract N00014-75-C-0451)
(AD-A048249; N89; TR-270) Avail: NTIS HC A02/MF A01 CSCL 12/1

A function f on (0, infinity) is completely monotone if it possesses derivatives of all orders, and the successive derivatives alternate in sign. It is shown that for each x the value of f(x) lies between any two consecutive partial sums of the expansion of f(x) in Taylor series. The given result can be applied to various functions such as the hypergeometric and confluent hypergeometric functions, which are widely used in applied mathematics. Some statistical applications are also given. GRA

N78-18843# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
DIRECT SOLUTIONS OF LARGE, SPARSE LINEAR SYSTEMS M.S. Thesis
Michael F. Poore Dec. 1976 153 p refs
(AF Proj. 2304)
(AD-A047776; AFIT/GEO/PH/77-3) Avail: NTIS MF A01 CSCL 12/1

A comparison is made of the merits of three popular algorithms for direct solutions of large, sparse matrices: Gaussian Elimination, LU Decomposition, and Gauss-Jordan Reduction. A mathematical theory discussion explains the algorithms and predicts their performance for arbitrary and strongly structured matrices. Particular emphasis is placed on solution accuracy and the efficient use of core space. The same test problems are used to analyze the Gaussian Elimination algorithm programmed by this student. From a study of the performance of several Gaussian solution strategies, a new strategy is developed which offers the user a range of options for his particular programming needs. The salient points of this strategy include some stability features of partial pivoting and some array optimization similar to minimum row/minimum column pivoting. The final Gaussian Elimination program is enhanced by a new packing scheme which is highly suited for the CDC 6600 computer: many arrays can be compacted into a single array by subdividing the long computer word structure. A final qualitative comparison is presented from which an optimal solution method is proposed and further study recommended. GRA

N78-18844# Army Materiel Systems Analysis Activity, Aberdeen Proving Ground, Md.
A GOODNESS-OF-FIT TEST FOR A CLASS OF NONHOMOGENEOUS POISSON PROCESSES
David L. Clark Dec. 1977 27 p refs
(DA Proj. 1R7-65706-M-541)
(AD-A048180; AMSAA-TR-210) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper discusses a goodness-of-fit test for a class of nonhomogeneous Poisson processes. This class of processes has been used to describe the phenomena of reliability growth and of the occurrence of failures in a complex, repairable system. Improved tables of percentiles of the small distribution of the Cramer-von Mises statistic in which a parametric exponent is estimated are provided for use in the test. The test can also be used to test the hypothesis that a random sample comes from a cumulative distribution function which can be expressed as an unknown positive power of a specified cdf. Author (GRA)

N78-18845# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN ALGORITHMIC APPROACH FOR REDUCING KINEMATICALLY SIMILAR DIFFERENTIAL SYSTEMS M.S. Thesis
Kevin Dolan Dec. 1977 88 p refs
(AD-A047781; AFIT-GCS/MA/77D-1) Avail: NTIS HC A05/MF A01 CSCL 09/2

Methods of reducing linear homogeneous differential matrix equations of the form X = A(t)X by kinematically similar transformations are presented in this thesis. Classical equivalence and similarity relationships between matrices with elements belonging to the polynomial domain with coefficients belonging to the field of real numbers are obtained which give necessary

and sufficient conditions for the existence of solutions to certain polynomial equations. Block reduction techniques using kinematically similar transformations lead to a discussion of iterative and non-iterative solution methods for the Liapunov matrix equation, Liapunov differential matrix equation, Riccati matrix equation, and the Riccati differential matrix equation. Author (GRA)

N78-18846# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

APPROXIMATION OF ZEROS OF FUNCTIONS ARISING IN THE ENGINEERING SCIENCES M.S. Thesis

John W. Lukes Dec. 1977 61 p refs

(AD-A047783; AFIT-GCS/MA/77-D-3) Avail: NTIS HC A04/MF A01 CSCL 12/1

This thesis extends work which takes a function defined by a second order differential equation and determines an interval on which that function either has a zero or attains a minimum, bounded value. Theorems for locating zeros are proved for functions of a single real variable, functions of two real variables, and real vector-valued functions. Algorithms suitable for computer adaptation are presented in examples which locate zeros of such functions occurring in the engineering sciences as Legendre polynomials, Laguerre polynomials, Emden's equation, and Duffing's equation; special emphasis is given to the zeros of Bessel functions J sub n(X). The methods developed in this work are useful in optimization theory; they also can be used to obtain good initial approximations of zeros for starting iterative algorithms, such as the Newton-Raphson method, which gives more exact zero values. GRA

N78-18847# Clemson Univ., S.C. Dept. of Mathematical Sciences.

ON A GENERALIZATION OF FREUND'S BIVARIATE FAILURE MODEL

Thomas J. Tosch and Paul T. Holmes 1 Jun. 1977 11 p refs

(Contract N00014-75-C-0451)

(AD-A048152; N86; TR-252) Avail: NTIS HC A02/MF A01 CSCL 12/1

A bivariate failure model is proposed in which the residual lifetime of one component is dependent on the working status of the other. General properties of the model are discussed, and maximum likelihood estimates of the parameters are found in a bivariate exponential-like case. Author (GRA)

N78-18848# Clemson Univ., S.C. Dept. of Mathematical Sciences.

TSA: STATISTICAL PROGRAMS FOR INTERACTIVE TIME SERIES ANALYSIS

K. T. Wallenius 30 Sep. 1977 49 p

(Contract N00014-75-C-0451)

(AD-A048151; N85; TR-268) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report is a description of TSA, an interactive package of computer programs designed to implement Box-Jenkins type of analysis of univariate time series. In addition to the usual features found in many similar packages, TSA offers training modules which facilitate learning the 'art' of successful time series analysis. Author (GRA)

N78-18849# Clemson Univ., S.C. Dept. of Mathematical Sciences.

DISTRIBUTION OF SAMPLE CORRELATION COEFFICIENTS

Khursheed Alam Sep. 1977 11 p refs

(Contract N00014-75-C-0451; NR Proj. 042-271)

(AD-A048126; N88; TR-266) Avail: NTIS HC A02/MF A01 CSCL 12/1

Let (Y,X sub 1, ...,X sub K) be a random vector distributed according to a multivariate normal distribution, and let R sub i denote the sample correlation coefficient between Y and X sub i. The joint distribution of R sub 1,..,R sub k are derived and given its asymptotic property. GRA

N78-18850# Utah Univ., Salt Lake City. Dept. of Mathematics.

BOUNDARY VALUE PROBLEMS AND PERIODIC SOLUTIONS OF NONLINEAR ORDINARY, FUNCTIONAL AND PARTIAL DIFFERENTIAL EQUATIONS Final Report, 15 Jun. 1974 - 14 Jun. 1977

Klaus Schmitt 8 Aug. 1977 8 p refs

(Contract DAHC04-74-C-0208; Grants DAHC04-75-G-0175; DAAG29-76-G-0186)

(AD-A048170; ARO-12048.8-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

This report summarizes the research findings of a three year period of G.B. Gustafson and the author in the areas of ordinary and partial differential equations (linear and nonlinear theory). In particular the results obtained are concerned with properties of Green's functions and matrices defined by linear differential operators and their implication to the study of nonlinear problems, with existence theory for periodic solutions of systems of nonlinear ordinary and elliptic partial differential equations, with nonlinear boundary value problems of Dirichlet and Neumann type for elliptic partial differential equations, with properties of nonlinear diffusion equations such as the existence of maximal and minimal solutions of initial and initial boundary value problems and connectedness properties of solution sets, and finally with abstract coincidence and fixed point theorems which lend themselves to the study of nonlinear problems for differential equations. Author (GRA)

N78-18851# Clemson Univ., S.C. Dept. of Mathematical Sciences.

COMPONENT-WISE MINIMAX PROPERTY OF STEIN'S RULE

Khursheed Alam Jul. 1977 14 p refs

(Contract N00014-75-C-0451)

(AD-A048125; N87; TR-255) Avail: NTIS HC A02/MF A01 CSCL 12/1

For estimating the mean of a p-variate normal distribution a family of estimators known as Stein's estimators were known to dominate the maximum likelihood estimator and were therefore minimax when p > or = to 3, under quadratic loss, equal to the sum of squared errors of the components of the estimator. It is shown that for a subfamily, the vector consisting of any K components of the estimator was also minimax for estimating the corresponding components of the mean vector, where 3 < or = to K < or = to p. Author

N78-18852# Stanford Univ., Calif. Dept. of Operations Research.

TIME-DEPENDENT MATHEMATICAL PROGRAMS Final Report, 25 Jun. 1974 - 24 Jun. 1977

B. Curtis Eaves 23 Nov. 1977 7 p

(Contract DAAG29-74-C-0032)

(AD-A048428; ARO-12396.6-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

The principal device and unifying theme of research summarized here is to be the homotopy principle for solving equations. To solve a given system of equations, the system is first deformed to one which is trivial and has a unique solution. Beginning with the solution to the trivial problem a route of solutions is followed as the system is deformed, perhaps with retrogression, back to the given system. The route terminates with a solution to the given problem. The principle was first stated as such in Homotopies for Computation of Fixed Points, a research report by the principle investigator which was supported earlier by ARO. Principal accomplishments under the research contract is the accomplishment of significant unification; in particular, it was shown that the complementary pivot and fixed point methods are all in theory the same and that a strong link between these methods and differential topology exists. This report consists of abstracts of eight reports emanating from the research. Author (GRA)

N78-18853# Stanford Univ., Calif. Dept. of Statistics.

ON THE DISTRIBUTION OF THE GREATEST COMMON DIVISOR

Persi Diaconis and Paul Erdos 10 Oct. 1977 13 p refs

(Contract N00014-76-C-0475; Grant DAAG-29-77-G-0031)

(AD-A048791; TR-252) Avail: NTIS HC A02/MF A01 CSCL 12/1

The limiting joint distribution of the least common multiple and the greatest common divisor is determined. The lead term is given for the moments of both marginal distributions. The

results are applied to the problem of reconstructing the sample size from a percentage classification. Author (GRA)

N78-18854# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
PARTIAL DIFFERENTIAL RATE EQUATIONS FOR A BILEVEL ABSORBER
B. J. Pernick Dec. 1977 42 p refs
(AD-A048601; RM-646) Avail: NTIS HC A03/MF A01 CSCL 20/6

The interaction of a directed beam of radiation with an absorber is described using a two level model. Transmitted light intensities and level populations are treated as functions of temporal and spatial independent variables and the general rate equations are given as partial differential equations. Additionally, combinations of material constants are identified as scale parameters and used to express the rate equations in nondimensional form as a hyperbolic partial differential equation in canonical form. One integration yields a time-independent relationship between two transmitted beam intensities at different wavelengths. Also described are several calibration experiments to evaluate material parameters. Author (GRA)

N78-18855# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Information Processing and Computer Science.
A NOTE ON THE STABILITY REGIONS OF THE BACKWARDS DIFFERENTIATION METHODS
Gustaf Soederlind 1977 20 p refs
(TRITA-NA-7708) Avail: NTIS HC A02/MF A01

Some properties of the stability regions are discussed. A table containing some important data on these stability regions is presented. For the k-step method (1 smaller than or equal to K smaller than or equal to 8), the boundary of the stability regions is plotted. Author (ESA)

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N78-18856 California Univ., Riverside.
GENERALIZED STOCHASTIC NETWORK AND STATISTICAL DECISION ANALYSIS Ph.D. Thesis
Hussein Sayed Shaarawy 1974 130 p
Avail: Univ. Microfilms Order No. 77-18282

A general methodology is developed for modeling stochastic dynamic systems in a decision making environment. Using a semi-Markov Process as a vehicle to model such systems, a transition analysis was performed to obtain the interval transition probabilities and the probability distribution of the number of transitions. The states in the model were classified and the absorbing state concept to obtain the competion time statistic was used. Associating every state with its direct and indirect cost marginal cost analysis was incorporated to have a more complete picture of the model with estimated discount costs. The Logical Decision Table was used as a communication bridge in programming the model. Dissert. Abstr.

N78-18857 Stanford Univ., Calif.
RANDOM COVERAGE PROBLEMS IN GEOMETRICAL PROBABILITY WITH AN APPLICATION TO TIME SERIES ANALYSIS Ph.D. Thesis
Andrew Francis Siegel 1977 105 p
Avail: Univ. Microfilms Order No. 77-25726

Moments of coverage and the distribution of coverage were calculated in the special case in which N arcs, each of length a, are placed independently with their centers uniformly distributed over the circumference of a circle. A recursive integral equation was derived and solved to yield, explicitly and in computable form, all of the moments of coverage. From these moments, the distribution of coverage was obtained and shown to be a mixture of a degenerate and a continuous random variable. Formulae are given for the mass point, the mixing probability, and the density of the continuous part, as well as for the cumulative distribution function of the coverage itself. It is shown that the continuous part tends asymptotically to an exponential distribution as N tends to infinity. There is a relation between this circle coverage problem and testing for the significance of a periodic trend in a time series. Dissert. Abstr.

N78-18858# Mathematical Applications Group, Inc., Elmsford, N. Y.
FORWARD MONTE CARLO METHOD FOR THE SOLUTION OF TIME-DEPENDENT HEAT CONDUCTION EQUATION Final Report, 19 Apr. 1976 - 30 Aug. 1977
Eugene S. Troubetzkoy Dec. 1977 66 p refs
(Contract DAAG29-76-C-0035)
(AD-A048268; P-7133) Avail: NTIS HC A04/MF A01 CSCL 20/13

A forward Monte Carlo method has been developed to solve the time-dependent heat conduction or diffusion equation. The general method has been implemented so as to cover a variety of boundary conditions. The method is based on a floating volume random walk, similar to the one in an adjoint method. A novel problem has been posed, and successfully solved, on the treatment of boundary conditions. The solution required the introduction of a biasing function, leading to a biased random walk. The first step of the random walk is particular to the forward method. The succeeding steps can be considered self-adjoint, as they are identical in the forward and adjoint case. Author (GRA)

N78-18859# Clemson Univ., S.C. Dept. of Mathematical Sciences.
DISTRIBUTION OF A SUM OF ORDER STATISTICS FROM THE GAMMA DISTRIBUTION
K. T. Wallenius and Khursheed Alam Sep. 1977 16 p refs
(Contract N00014-75-C-0451)
(AD-A048127; N77; TR-262) Avail: NTIS HC A02/MF A01 CSCL 12/1

The distribution of the sum of K largest order statistics in a sample from the gamma distribution with n degrees of freedom is expressed as a linear function of gamma density functions if n is integer valued and is approximated by a probability distribution of the same form if n is not integer valued. Author (GRA)

N78-18860# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
ON RULES BASED ON SAMPLE MEDIANS FOR SELECTION OF THE LARGEST LOCATION PARAMETER
Shanti S. Gupta and Ashok K. Singh Nov. 1977 39 p refs
(Contract N00014-75-C-0455)
(AD-A047948; MIMEO-Ser-514) Avail: NTIS HC A03/MF A01 CSCL 12/1

The problem of selection of a subset containing the largest of several given location parameters is considered, and selection rules based on sample medians are proposed and investigated. Selection of the largest normal mean is considered in detail and some new results for double exponential populations are also obtained. Numerical comparisons in the case of equally spaced normal means are made between the medians procedure and the means procedure. The asymptotic relative efficiency (ARE) of the medians procedure relative to the means procedure is also computed, assuming that the normal means are in a slippage configuration. The means procedure is found to be much better than the medians procedure in the sense of ARE. However, if the normal populations are highly contaminated, the proposed rule based on sample medians is superior to the means procedure. GRA

N78-18861# Institute for Defense Analyses, Arlington, Va. Program Analysis Div.
A REVIEW OF DOAE PAPERS ON MATHEMATICAL MODELS OF ATTRITION Final Report
Alan F. Karr Nov. 1977 56 p refs
(AD-A048609; AD-E500004) Avail: NTIS HC A04/MF A01 CSCL 12/1

This paper is a descriptive and critical review of seven papers on the mathematics of combat attrition prepared by staff members of the Defence Operational Analysis Establishment of the U.K. The papers reviewed are A Bivariate Probability Distribution; The Moments of the Distribution of Battle States; Homogeneous Battles with General Attrition Functions; The Distribution of the Duration of Battle; Approximate Moments of the Distribution of

States of a Simple Heterogeneous Battle; and Stochastic 'Linear Law' Battles; and Moments of the Distribution of States for a Battle with General Attrition Functions. Emphasis of the reviews is on mathematical aspects of the stochastic attrition process treated in the papers. GRA

N78-18862# European Space Research and Technology Center, Noordwijk (Netherlands).
THE DETERMINATION OF SYMMETRICAL SPHERICAL HARMONIC DISTRIBUTIONS FROM LIMITED DATA
G. L. Webb Paris ESA Sep. 1977 17 p refs
(ESA-TM-178) Avail: NTIS HC A02/MF A01

The problem considered is that of finding the number of harmonics of a spherical harmonic distribution which may be determined under various assumptions about the symmetry of the distribution, with data obtained from a small number of particle counters (telescopes) mounted on a spinning satellite. Four classes of symmetry were investigated: (1) when the poles of all the harmonics are coincident and this direction is known (named for a particular instance of the distribution pitch angle (independent); (2) as (1) but the direction is unknown (pitch angle dependent); (3) when the poles of each harmonic are coincident, and unknown, but are not related from harmonic to harmonic (axially symmetric); (4) where no symmetries are assumed (three-dimensional). The work was carried out to discover the minimum number of telescopes needed for resolving each of the above cases when (a) harmonics 0 and 1, (b) harmonics 0,1 and 2 (c) harmonics 0,1,2 and 3 are considered. The relevant equations, in general nonlinear, were derived and investigated numerically in an attempt to find where multiple solutions, or other local minima which are not solutions, exist. Author (ESA)

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N78-18863 Cornell Univ., Ithaca, N. Y.
NETWORK RELIABILITY ANALYSIS: ALGORITHMS AND COMPLEXITY Ph.D. Thesis
Michael Owen Ball 1977 219 p
Avail: Univ. Microfilms Order No. 77-28184

The problem of determining the reliability of a stochastic network is addressed. A general algorithm to compute several reliability measures on an indirected network is presented. The measures considered are the probability that a specified pair of nodes can communicate, the probability that all node pairs can communicate and the expected fraction of node pairs communicating. It also computes these measures when all communication must proceed through a root node. Computational results are given. The combinational structure underlying reliability analysis problems are examined. The results are used to derive bounds on the running time of an algorithm to compute the probability that all nodes can communicate on networks in which only links can fail. Dissert. Abstr.

N78-18864 Texas Univ., Austin.
APPLICATION OF SENSITIVITY THEORY AND OPTIMIZATION TECHNIQUES TO MODELS OF LARGE SCALE SYSTEMS Ph.D. Thesis
Adel Rasheed Marouf 1977 218 p
Avail: Univ. Microfilms Order No. 77-29063

A functional block diagram was formulated for a specific large scale system, namely the World Model. Sensitivity functions for large systems described by non-linear differential equations were developed to provide relative quantitative measures, based on precise mathematical analysis, for the variations of the states of the system due to perturbations in its control parameters and or initial conditions. The digital computer simulation results proved helpful in gaining better insight into the dynamical behavior of the model. Dynamic optimization procedures were also developed for the selection of control parameter settings that will force a system into various dynamic optimal modes with respect to specific performance criteria. The results of digital computer simulation of those optimization techniques provided alternative policies indispensable to the optimal control of the system model. Dissert. Abstr.

N78-18865# South Carolina Univ., Columbia. Coll. of Engineering.
CONCEPT AND USE OF MODELS, PART 1 AND PART 2
W. H. Hoppmann, II Nov. 1977 341 p refs
(Contract DAAD05-74-C-0722; 1R7-65706-M-541)
(AD-A048594; AMSAA-TR-187-Pt-1; AMSAA-TR-187-Pt-2)
Avail: NTIS HC A15/MF A01 CSCL 12/2

An attempt is made to present a unified view of modeling. Beginning with the earliest concept of model, a brief history of the subject is presented for the period beginning from prehistoric times into the twentieth century. The evolution of the concept of model is discussed in some detail, and a taxonomy of the subject is suggested. Special attention is given to the relationship between the concept of model and the prevailing ideas of space, time, and matter. The role of dimensional analysis is reviewed and its relationship to modeling examined at length. Specific types of models which constitute the taxonomy are defined and illustrated with numerous examples. The idea of a Newtonian model is introduced and then extended to cover many physical cases. The new concept of disclosive model and its role is defined and illustrated. Its historical origin is reviewed. Its value in the evolution of generalized modeling is examined at length. GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N78-18866 Colorado Univ., Boulder.
INTERPLAY BETWEEN ALGEBRA AND TOPOLOGY: GROUPOIDS IN A VARIETY Ph.D. Thesis
Carol Ann Bateson 1977 92 p
Avail: Univ. Microfilms Order No. 77-29897

The automorphism group of every object of every groupoid in V was isomorphic to a subgroup of the fundamental group of some arc component of some topological algebra in V. It was shown that the fundamental group of any arc component of any topological algebra in V was isomorphic to the automorphism group of some object of some groupoid in V. It is shown that if V was any variety, it made F sub V (P), the free V-algebra on the points of a two dimensional simplicial complex P, into a CW complex in such a way that F sub V (P) is a topological algebra in V and P inherits from F sub V (P) its usual topology. Dissert. Abstr.

N78-18867 Kansas Univ., Lawrence.
A STUDY OF REMOTE POINTS OF METRIC SPACES Ph.D. Thesis
Catherine Louise Gates 1977 82 p
Avail: Univ. Microfilms Order No. 77-28869

The set of remote points of metric spaces without isolated points is studied. The definition of general remote points of a space as those free z-ultrafilters which contain no nowhere dense zero sets provides for the extension of the concept to arbitrary completely regular spaces. If a closed irreducible continuous function maps a completely regular space X onto a perfectly normal space Y without isolated points, then the Stone extension of the map restricted to the general remote points of X is a homeomorphism onto the general remote points of Y, and the inverse image of the general remote points of Y is precisely the general remote points of X. This fact yields the primary technique used to determine properties of the set of remote points. Of considerable usefulness is the resulting fact that the set of general remote points of the absolute of a metric space without isolated points is homeomorphic to the remote points of the space. Coabsolute metric spaces without isolated points have homeomorphic sets of remote points. Dissert. Abstr.

N78-18868 Houston Univ., Tex.
GRAPH-DENSE LINEAR TRANSFORMATIONS IN HILBERT SPACE Ph.D. Thesis
George Osborne Golightly 1977 55 p
Avail: Univ. Microfilms Order No. 77-28770

A concept to the instance in which T is a linear function from a dense linear subspace of a complete inner product space to a complete inner product space is investigated. The investigation is concerned with two principal questions. The first of these relates to the problem of viewing non-closed, unbounded linear functions as arising in a natural fashion. Two processes, one essentially geometric and the other algebraic, for constructing inner products relatively to which a given linear function from a special class is or is not continuous are presented. The second of the two questions involves the extent to which continuity of a function T from a Hilbert space to a Hilbert space is a consequence of linearity. Dissert. Abstr.

N78-18869 Wisconsin Univ., Madison.
FAKE QUATERNIONIC PROJECTIVE SPACES FROM A HOMOTOPY POINT OF VIEW Ph.D. Thesis
Charles Andrew McGibbon 1977 105 p
Avail: Univ. Microfilms Order No. 77-19775

The infinite dimensional quaternionic space, when viewed as a CW-complex, has a cell in every fourth dimension. The attaching maps in this case are the quaternionic Hopf fibrations. An attempt was made to alter one of these attaching maps by an element of finite order. A fake projective n-space, KP to the n power, can be constructed in this manner. The problem is then to determine whether or not this KP to the n power extends to (or embeds as the 4n- skeleton of) an infinite dimensional projective space. In many cases they do not. In fact, for each odd prime p, there are infinitely many (as n approaches infinity) fake projective n-spaces KP to the n power such that: (a) KP to the n power is not p-equivalent to HP to the n power. (b) KP to the n power does not extend to a KP to the n+r power, where r = (p-1)/2. Dissert. Abstr.

N78-18870 Vanderbilt Univ., Nashville, Tenn.
ON CONTINUOUS RINGS Ph.D. Thesis
James Lowell Forde 1977 49 p
Avail: Univ. Microfilms Order No. 77-30358

Utumi has called a ring left continuous provided: (1) each left ideal is essential in one generated by an idempotent and (2) each left ideal isomorphic to one generated by an idempotent is itself generated by an idempotent. A ring was said to be continuous if it was both left and right continuous. A left self-injective ring was necessarily left continuous, but the converse fails even for rings that were both left and right Artinian. It was proven, however, that a continuous ring which satisfied the maximum condition on left annihilators was quasi-Frobenius. Dissert. Abstr.

N78-18871*# Houston Univ., Tex. Dept. of Mathematics.
QUASI-NEWTON METHODS
Homer F. Walker Feb. 1978 17 p refs
(Contract NAS9-15000)
(NASA-CR-151637; Rept-67) Avail: NTIS HC A02/MF A01 CSCL 12A

The problem to be solved is formulated precisely and the introduction of quasi-Newton methods is motivated by considering the classical Newton and secant methods and their properties. Three highly successful quasi-Newton methods are surveyed: Broyden's method for the solution of general nonlinear equations, and the Davidon-Fletcher-Powell and Broyden-Fletcher-Goldfarb-Shanno procedures for unconstrained minimization. Finally, the properties of these methods are compared to those of Newton's method and UHMLE in potential applications to maximum-likelihood estimation of parameters in mixture distributions. Author

N78-18872# Stanford Univ., Calif. Dept. of Computer Science.
A SEPARATOR THEOREM FOR PLANAR GRAPHS
Richard J. Lipton and Robert E. Tarjan Oct. 1977 33 p refs
(Contract N00014-76-C-0688; Grant NSF MCS-75-22870)
(AD-A048786; SU-STAN-CS-77-627) Avail: NTIS HC A03/MF A01 CSCL 12/1

Let G be any n-vertex planar graph. Prove that the vertices of G can be partitioned into three sets A, B, C such that no edge joins a vertex in A with a vertex in B, neither A nor B contains more than 2n/3 vertices, and C contains no more than 2(sq.rt 2)(sq. rt n) vertices. An algorithm is exhibited which finds such a partition A, B, C in o(n) time. GRA

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

No abstracts in this category.

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N78-18873*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CONCORDE NOISE-INDUCED BUILDING VIBRATIONS JOHN F. KENNEDY INTERNATIONAL AIRPORT
W. H. Mayes, R. DeLoach, D. G. Stephens, J. M. Cawthorn, H. K. Holmes, R. B. Lewis, B. G. Holliday, and D. W. Ward Jan. 1978 38 p refs
(NASA-TM-78660; Rept-1) Avail: NTIS HC A03/MF A01 CSCL 20A

The outdoor and indoor noise levels resulting from aircraft flyovers and certain nonaircraft events were recorded at six home sites along with the associated vibration levels in the walls, windows, and floors of these test homes. Limited subjective tests conducted to examine the human detection and annoyance thresholds for building vibration and rattle caused by aircraft noise showed that both vibration and rattle were detected subjectively in several houses for some operations of both the Concorde and subsonic aircraft. Preliminary results indicate that the relationship between window vibration and aircraft noise is: (1) linear, with vibration levels being accurately predicted from OASPL levels measured near the window; (2) consistent from flyover to flyover for a given aircraft type under approach conditions; (3) no different for Concorde than for other conventional jet transports (in the case of window vibrations induced under approach power conditions); and (4) relatively high levels of window vibration measured during Concorde operations are due more to higher OASPL levels than to unique Concorde source characteristics. Author

N78-18874*# DyTec Engineering, Inc., Huntington Beach, Calif.
INVESTIGATION OF GROUND REFLECTION AND IMPEDANCE FROM FLYOVER NOISE MEASUREMENTS Final Report
Robert L. Chapkis and Alan H. Marsh Feb. 1978 142 p refs
(Contract NAS1-14797)
(NASA-CR-145302; DyTec-R-7708) Avail: NTIS HC A07/MF A01 CSCL 20A

An extensive series of flyover noise tests was conducted for the primary purpose of studying meteorological effects on propagation of aircraft noise. The test airplane, a DC 9-10, flew several level-flight passes at various heights over a taxiway. Two microphone stations were located under the flight path. A total of 37 runs was selected for analysis and processed to obtain a consistant set of 1/3 octave band sound pressure levels at half-second intervals. The goal of the present study was to use the flyover noise data to deduce acoustical reflection coefficients and hence, acoustical impedances. Author

N78-18875# Science Applications, Inc., McLean, Va.
FORMULATION OF AN ADVANCED COMPUTATIONAL CAPABILITY FOR THE PREDICTION OF TRANSMISSION LOSS IN THE OCEAN
Joseph Czika, Charles W. Spofford, and Robert A. Stieglitz May 1977 34 p
(Contract N00014-76-C-0488)
(AD-A048262; SAI-78-567-WA) Avail: NTIS

HC A03/MF A01 CSCL 17/1

This report documents the results of a study whose objective was to formulate a unified state-of-the-art propagation-loss model capable of handling steep as well as shallow-angle paths in a range-dependent environment. The approach which has been developed would combine the parabolic-equation (PE) results for non bottom-interacting paths with ray results (from FACT or the Multiple-Profile Program--MPP) for bottom-reflected paths. This marriage would capitalize on the accuracy of PE for the RR and RSR paths where diffraction effects limit the ray models, while using the ray formulation for the higher-angle paths where diffraction is not dominant and the ray approach is more appropriate. Author (GRA)

N78-18876# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).

EXPOSURE TO ULTRASONIC NOISE IN THE CANADIAN FORCES

R. B. Crabtree and S. E. Forshaw Jul. 1977 32 p refs
(AD-A048115; DCIEM-TR-77X45) Avail: NTIS HC A03/MF A01 CSCL 06/17

The high-frequency noise produced by ultrasonic cleaning devices at CFB North Bay and CFB Trenton is sufficiently intense to produce effects such as nausea, headaches, tinnitus and fatigue among exposed personnel. Although the 20-kHz one-third octave-band sound pressure levels observed close to these units are well under 140 db (the level below which damage to the human ear is thought not to occur), they nevertheless exceed the levels recommended for hearing conversation (105 db at an operator's position, 95 db within 15 feet of an operator). The most effective means of reducing the noise radiated from these cleaners is to contain each unit in an appropriately ventilated enclosure or room. Personnel operating or working close to units not enclosed should wear hearing protection. Author (GRA)

N78-18877# Yale Univ., New Haven, Conn. Systems and Information Sciences.

FREQUENCY SPREADING IN FORWARD SURFACE SCATTERING

John G. Zornig Dec. 1977 42 p refs
(Contracts N00014-77-C-0237; N00014-75-C-1014)
(AD-A048741; S/IS-7710) Avail: NTIS HC A03/MF A01 CSCL 20/1

An experimental study of frequency spreading in acoustic signals forward scattered from model tank wind driven water surfaces has been performed. The study employed wide band probing signals to doubly sample the surface scatter process. A high degree of precision and demonstrated repeatability was produced. Parameters varied in the study included grazing angle, surface roughness, wind direction, and acoustic wavelength. Rayleigh roughness parameters varying from 0.7 to 12. were studied. The results of the study consist of a large number of measured frequency spreading functions and an analysis of the frequency shift of the mean scattered power and rms spread as a function of wavelength for each condition of wind and grazing angle. This analysis indicates qualitative agreement with current theory in the general form of the spread spectrum at high and low roughness, and in the linear dependence of the mean shift on frequency. The data showed a marked sideband asymmetry in symmetric geometric configurations, however, which is not consistent with any published analytical model. In addition, at short wavelengths, frequency spread seemed not to increase linearly with carrier frequency. Author (GRA)

N78-18878# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Berlin (West Germany). Inst. fuer Turbulenzforschung.

ACOUSTIC INTERFERENCE EFFECTS AND THE ROLE OF HELMHOLTZ NUMBER IN AERODYNAMIC NOISE

H. V. Fuchs 1977 30 p refs Presented at the Symp. on Turbulence, Berlin, 1-5 Aug. 1977
(DLR-IB-257-77/11) Avail: NTIS HC A03/MF A01

Recent coherence measurements in the near and far fields of both cold-air model jets and real jet engine flows show a strong axisymmetric structure in both the turbulent flow and the acoustic wave field radiated at small angles to the jet axis. Coherent source phenomena occur at the relevant Strouhal numbers around the spectral peaks in the turbulent and acoustic pressure fields and persist at high Reynolds and Mach numbers. Empirical scaling laws common in aerodynamic noise were frequently based on merely a typical density, velocity, and length of the mean flow as the characteristic parameters. Such a simple dependence emerges from a dimensional analysis of Lighthill-Curle-type source integrals by assuming a small-scale eddy structure of the turbulence. For these scaling laws to be strictly valid the scale 1c of the individual turbulent sources must be small compared to the acoustic wave length radiated. In cases where the coherently radiating sources are found to be not acoustically compact, scaling laws should incorporate, additionally, at least one of the following parameters: acoustic compactness ratio, turbulence coherence ratio, and Helmholtz number. Author (ESA)

N78-18879# Federal Communications Commission, Washington, D. C. Research and Standards Div.

INTERFERENCE TO AUDIO DEVICES AND RECEIVERS FROM SIGNALS NEAR 27, 220 AND 900 MHz

John H. McMahon Nov. 1977 75 p
(PB-274887/9; FCC/OCE/RS77-03) Avail: NTIS HC A04/MF A01 CSCL 17B

Data gathered for determining the best location within the radio frequency spectrum for a personal radio service is presented. Bounded by the small size of the sample of devices tested, and the greater spectral purity of the interfering emissions used in these tests, the following guideline conclusions are offered: (1) the ranking of the three frequencies with respect to least interference to audio devices, AM receivers, and FM receivers is: first 27 MHz, second 220 MHz, and third 925 MHZ; and (2) the ranking with respect to least interference to television receivers is; first 27 MHz, second 925 MHz, and third 220 MHz. GRA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N78-18880 Houston Univ., Tex.

FORMAL AND COMPUTATIONAL STUDIES OF MOLECULAR COLLISION DYNAMICS Ph.D. Thesis

Rudolf Goldflam 1977 227 p
Avail: Univ. Microfilms Order No. 77-28769

The dynamics of rotational energy transfer in atom-molecule collisions is studied formally and computationally within the framework of the coupled states and infinite order sudden approximations. Both approximations are rederived lead to approximate wavefunctions and amplitude densities which are non-diagonal in the R-helicity projection of the rotor angular momentum. The formal theory of relaxation phenomena is derived within the framework of these approximations and tested computationally. The consequences of using fully quantum mechanical approximations are discussed. The method is applied computationally to the collinear rearrangement problem.
Dissert. Abstr.

N78-18881 Yale Univ., New Haven, Conn.

ELECTRON SCATTERING FROM VIBRATIONALLY EXCITED NITROGEN Ph.D. Thesis

John Adam Michejda 1977 226 p
Avail: Univ. Microfilms Order No. 77-28155

A low energy monoenergetic electron beam crossed with a molecular beam of excited nitrogen produced in a microwave discharge was used to investigate electron scattering from vibrationally excited nitrogen. Both the electron transmission and the trapped electron techniques were used to determine the populations of vibrational levels of the excited gas. Changes in the threshold behavior and vibrational content were used to measure the ionization cross sections from N2 in v = 1 and v = 2. A numerical model is developed in which parameters are fit to the shapes and relative magnitudes of the ionization cross section, and the relative importance of the direct and autoionization processes are separated. The results suggest that the ionization cross section of N2 in v = 0 is dominated by direct process

and by autoionization from Rydberg states converging to first electronically excited state of N2(+), but the ionization of N2 in v = 1 and v = 2 is dominated by autoionization of Rydberg states converging to higher vibrational levels of ground state ion. Dissert. Abstr.

N78-18882*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

EXCHANGE AND RELAXATION EFFECTS IN LOW-ENERGY RADIATIONLESS TRANSITIONS

Mau Hsiung Chen (Oregon Univ., Eugene), Bernd Crasemann (Oregon Univ., Eugene), Michio Aoyagi, and Hans Mark (Department of the Air Force, Washington, D. C.) [1978] 28 p refs (Grants NGR-38-003-036; DAAG29-78-G-0010)
(NASA-TM-79383) Avail: NTIS HC A03/MF A01 CSCL 20H

The effect on low-energy atomic inner-shell Coster-Kronig and super Coster-Kronig transitions that is produced by relaxation and by exchange between the continuum electron and bound electrons was examined and illustrated by specific calculations for transitions that deexcite the [3p] vacancy state of Zn. Taking exchange and relaxation into account is found to reduce, but not to eliminate, the discrepancies between theoretical rates and measurements. Author

N78-18883*# Colorado State Univ., Fort Collins. Dept. of Physics.

INDUSTRIAL ION SOURCE TECHNOLOGY Annual Report

Harold R. Kaufman Nov. 1977 161 p refs
(Grant NsG-3086)
(NASA-CR-135353) Avail: NTIS HC A08/MF A01 CSCL 20H

Plasma probe surveys were conducted in a 30-cm source to verify that the uniformity in the ion beam is the result of a corresponding uniformity in the discharge-chamber plasma. A 15 cm permanent magnet multipole ion source was designed, fabricated, and demonstrated. Procedures were investigated for texturing a variety of seed and surface materials for controlling secondary electron emission, increasing electron absorption of light, and improved attachment of biological tissue for medical implants using argon and tetrafluoromethane as the working gases. The cross section for argon-argon elastic collisions in the ion-beam energy range was calculated from interaction potentials and permits calculation of beam interaction effects that can determine system pumping requirements. The data also indicate that different optimizations of ion-beam machines will be advantageous for long and short runs, with 1 mA-hr/cm being the rough dividing line for run length. The capacity to simultaneously optimize components in an ion-beam machine for a single application, a capacity that is not evident in competitive approaches such as diode sputtering is emphasized. Author

N78-18884*# Nebraska Univ., Lincoln. Behlen Lab. of Physics.

GRAPHICAL EVALUATION OF RELATIVISTIC MATRIX ELEMENTS

Keh-Ning Huang [1978] 83 p refs
(Grants NGR-38-003-036; DAHC04-75-G-0021)
(NASA-CR-155774) Avail: NTIS HC A05/MF A01 CSCL 20H

A graphical representation of angular momentum was used to evaluate relativistic matrix elements between antisymmetrized states of many particle configurations having any number of open shells. The antisymmetrized matrix element was expanded as a sum of semisymmetrized matrix elements. The diagram representing a semisymmetrized matrix element was composed of four diagram blocks; the bra block, the ket block, the spectator block, and the interaction block. The first three blocks indicate the couplings of the two interacting configurations while the last depends on the interaction and is the replaceable component. Interaction blocks for relativistic operators and commonly used potentials were summarized in ready to use forms. A simple step by step procedure was prescribed generally for calculating antisymmetrized matrix elements of one and two particle operators. Author

N78-18885# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INTERACTIONS OF HIGH-ENERGY PARTICLES AND ATOMIC NUCLEI WITH NUCLEI, CHAPTER 7 THRU 11

V. S. Barashenkov 13 Jul. 1977 513 p refs Transl. into ENGLISH from "Vzaimodeystviya Vysokoenergeticheskikh Chastits i Atomnykh Yader s Yadrami" Moscow, 1972 p 468-648
(AD-A048311; FTD-ID(RS)T-1069-77) Avail: NTIS HC A22/MF A01 CSCL 20/8

Contents: Intranuclear Cascades with Many-Body Interactions; Emission of Complex Particles; Fragmentation; Nuclear Fission; and Inelastic Collisions of Nuclei. GRA

N78-18886# Texas Instruments, Inc., Dallas.

IC FABRICATION USING ELECTRON-BEAM TECHNOLOGY Quarterly Report, 1 Dec. 1976 - 1 Mar. 1977

Gilbert L. Varnell, Ronald A. Williamson, Terry L. Brewer, John L. Bartelt, Roger A. Robbins, and Claude D. Winborn Jul. 1977 36 p
(Contract DAAB07-76-C-8105)
(AD-A048307; TI-03-77-30; QR-2) Avail: NTIS HC A03/MF A01 CSCL 13/8

The technical and economic impact of electron-beam direct slice printing will be demonstrated on 256-bit bipolar RAMs. All electron-beam tapes necessary for fabricating the 256-bit bipolar RAMs have been generated. Advanced software techniques such as geometry sizing, sorting and increment/decrement were used. E-beam processes have been developed for all lithographic steps on the 256-bit bipolar RAMs. Because of the pattern distortion at epitaxial growth, the original alignment marker system was modified. Several lots using this new alignment marker system are in process. The design of the Automatic Slice Loader is complete. Author (GRA)

N78-18887# Naval Research Lab., Washington, D. C.

INTENSE FOCUSSED ION BEAMS AND THEIR INTERACTION WITH MATTER Interim Report

D. Mosher, G. Cooperstein, S. J. Stephanakis, Shyke A. Goldstein, D. G. Colombant, and Roswell Lee Nov. 1977 30 p refs
(AD-A048753; AD-E000082; NRL-MR-3658) Avail: NTIS HC A03/MF A01 CSCL 20/7

Recent experiments and theory dealing with the production, focussing, and interaction with matter of ion beams extracted from pinched-beam diodes is reviewed. Present experiments indicate that in excess of 300 kA of .8 MeV protons can be extracted from flat anode structures while deuterons can be focussed to about 70 kAsq cm over 2 sq cm target areas in a focussing geometry. Author (GRA)

N78-18888# California Univ., Berkeley. Lawrence Berkeley Lab.

MOLECULAR BEAM STUDIES ON MULTIPHOTON DISSOCIATION OF POLYATOMIC MOLECULES

E. R. Grant, P. A. Schulz, A. S. Sudbo, M. J. Coggiola, Y. R. Shen, and Y. T. Lee Jun. 1977 22 p refs Presented at Intern. Conf. on Multiphoton Processes, Rochester, N. Y., 6-9 Jun. 1977
(Contract W-7405-eng-48)
(LBL-6275; Conf-770653-2) Avail: NTIS HC A02/MF A01

The multiphoton dissociation of polyatomic molecules was studied under the collisionless molecular beam conditions used routinely. It was concluded that although the initial excitation is selective, nearly complete energy randomization must take place in the molecular vibrational degrees of freedom before decomposition. Author

N78-18889# Istituto Superiore di Sanita, Rome (Italy). Lab. delle Radiazioni.

NEXT - INSTRUCTION MANUAL

A. Calicchia and M. PaganiniFioratti (CNEN, Rome) 27 Jan. 1977 64 p ref In ITALIAN; ENGLISH summary
(ISS-T-77/1) Avail: NTIS HC A04/MF A01

The Italian version of the U.S. NEXT program is described. The program was defined to contribute a substantial improvement in radiation protection when using X-rays in medical diagnostics. Practical suggestions for selecting installations to be controlled and specific instructions for data collection are given. A computational technique for dosage estimation is presented and computer outputs are explained. Author (ESA)

N78-18890# Montpellier Univ. (France). Dept. de Physique Mathematique.
NARROWLOGY - PHENOMENOLOGY OF LOW ENERGY NARROW RESONANCE
F. M. Renard Jul. 1977 12 p refs
(PM/77/6) Avail: NTIS HC A02/MF A01

Interpretations are proposed for narrow structures with invariant masses in the range of 1 to 3 GeV (below charmonium) and with widths of the order of a few tens of MeV or less, recently observed at low energy. Order of magnitudes are given for widths and couplings to the photon. ESA

N78-18891# Istituto Superiore di Sanita, Rome (Italy). Lab. di Fisica.
THE STRUCTURE OF COMPLEXES OF MONO- AND POLYNUCLEOTIDES WITH METAL IONS OF THE FIRST TRANSITION GROUP. PART 1: CRYSTALLOGRAPHIC STUDIES
H. Pezzano and F. Podo 5 Apr. 1976 39 p refs 2 Vol.
(ISS-R-76/7-Pt-1) Avail: NTIS HC A03/MF A01

The achievements of X-ray crystallography on the study of the interactions of the metal ions of the first transition group (common activators or inhibitors for enzyme actions) with nuclei acid derivatives are reviewed, with emphasis on aspects concerned with the metal binding sites. The general results on crystallized complex compounds confirmed theoretical predictions about electron donor sites for the metal on the bases. On the other hand, the metal ion is generally coordinated to water molecules instead of being directly bound to the phosphates. Author (ESA)

N78-18892# Istituto Superiore di Sanita, Rome (Italy). Lab. di Fisica.
THE STRUCTURE OF COMPLEXES OF MONO- AND POLYNUCLEOTIDES WITH METAL IONS OF THE FIRST TRANSITION GROUP. PART 2: NUCLEAR MAGNETIC RESONANCE STUDIES
H. Pezzano and F. Podo 6 Apr. 1976 57 p refs 2 Vol.
(ISS-R-76/8-Pt-2) Avail: NTIS HC A04/MF A01

Nuclear magnetic resonance techniques allow the study of metal interactions with nucleic acid derivatives under physiological conditions. Selective line broadenings and chemical shift variations can be observed. The results, in general, confirm what has been found in the crystalline state. The corresponding reactivity depends on the base tautomeric equilibrium in solution. When a phosphate chain is present, the metal ion locates near the beta- and gamma-phosphate groups, but also binds the base moiety. On polynucleotide chains, most transition metals interact with external groups. Author (ESA)

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N78-18893 Iowa State Univ. of Science and Technology, Ames.
COMPARISON BETWEEN PHASE SHIFT DERIVED AND EXACTLY CALCULATED NUCLEON-NUCLEON INTERACTION MATRIX ELEMENTS Ph.D. Thesis
Alan Wayne Gregersen 1977 188 p
Avail: Univ. Microfilms Order No. 77-29836

Matrix elements calculated using the uncoupled channel Sussex approach to second order in distorted wave Born approximation were compared with matrix elements calculated using a square well potential. The square well potential illustrated the problem of the determining parameter independence balanced with the concept of phase shift difference. The super-soft core potential was used to discuss the systematics of the Sussex approach as a function of angular momentum as well as the relation between Sussex generated and effective interaction matrix elements. In the uncoupled channels the original Sussex method of extracting effective interaction matrix elements was found to be satisfactory. Dissert. Abstr.

N78-18894 Texas Univ., Austin.
COUPLED-CHANNEL ANALYSIS FOR HEAVY-ION INDUCED SCATTERING AND TRANSFER REACTIONS Ph.D. Thesis
Byung-taik Kim 1977 84 p
Avail: Univ. Microfilms Order No. 77-29055

Reformulation of the coupled channel (CC) calculations and a discussion of the development of a computer program was performed. Use of the CC distorted waves in calculating the cross sections for transfer reaction induced by heavy ions was attempted. A computer code was prepared for coupled channel Born approximation calculations (CCBA). Using these newly developed codes performed for a number of cases of heavy ion scattering and reactions, results were compared with experimental data. These CC and CCBA calculations were found to explain data which defy explanation in terms of more simple theories such as the optical model and the distorted wave Born approximation. Dissert. Abstr.

N78-18895 Tennessee Univ., Knoxville.
A SIMULATION MODEL FOR THE FX-75 RELATIVISTIC ELECTRON BEAM ACCELERATOR Ph.D. Thesis
Richard Loyd Copeland 1977 98 p
Avail: Univ. Microfilms Order No. 77-27651

A numerical model to predict the one dimensional voltage and current T.E.M. waveforms for the FX-75 relativistic electron beam accelerator was developed. The model consists of finite segments of coaxial transmission lines separated by lumped equivalent circuits representing the various discontinuity points. Each line segment was divided into two one dimensional grids with a 0.1 nanosecond one way transit time point to point grid separation for the backward and forward T.E.M. waves. The electron beam discharge at the anode-cathode gap position was represented by an R, L, C lumped equivalent circuit with generalized time varying parameters. A one dimensional time dependent four line load model was used to simulate the FX-75 accelerator. Numerical results were presented for two diode configurations and these results were compared to typical experimentally measured waveforms. Dissert. Abstr.

N78-18896# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
SUBSONIC GAS TARGET 14 MeV NEUTRON GENERATOR
V. Chattoorgoon and P. C. Stangeby 3 Oct. 1977 32 p refs Backup document for AIAA Synoptic scheduled for publication in Journal of Energy in May 1978
Avail: NTIS HC A03/MF A01

Intense 14 MeV neutron sources are under development in controlled thermonuclear fusion technology research for application to studies of materials damage. One of the simplest approaches to the production of intense 14 MeV neutron incorporates an intense tritium ion beam on a fast-flowing D2 target. A variety of gas target configurations have been proposed including a particularly promising variant, the subsonic gas target (SRT). An analysis is given of the neutron yield for a variety of SGT's, including units appropriate for the upgrading of existing solid target systems as well as for large scale, 10 to the 15th power and 10 to the 16th power n/s, units. It was found that solid (rotating) target 14 MeV neutron sources will be significantly improved both as to total source strength, and more particulary as to flux, by the addition of a gas target. Author

N78-18897*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN ANALYSIS OF THE TECHNICAL STATUS OF HIGH LEVEL RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT SYSTEMS
T. English, C. Miller, E. Bullard, R. Campbell, A. Chockie, E. Divita, C. Douthitt, E. Edelson, and L. Lees 1 Dec. 1977 289 p refs
(Contract NAS7-100)
(NASA-CR-155313; JPL-Pub-77-69) Avail: NTIS HC A13/MF A01 CSCL 18G

The technical status of the old U.S. mailine program for high level radioactive nuclear waste management, and the newly-developing program for disposal of unreprocessed spent fuel was assessed. The method of long term containment for both of these waste forms is considered to be deep geologic

isolation in bedded salt. Each major component of both waste management systems is analyzed in terms of its scientific feasibility, technical achievability and engineering achievability. The resulting matrix leads to a systematic identification of major unresolved technical or scientific questions and/or gaps in these programs. Author

N78-18898# Air Force Weapons Lab., Kirtland AFB, N. Mex.
SAFETY METHODOLOGY FOR SPACE NUCLEAR SYSTEMS Final Report
E. W. Holtzscheiter, Dermod Kelleher, G. W. Mitchell, Michael L. Crawford, and J. A. Sholtis Oct. 1977 76 p refs
(AF Proj. 2007)
(AD-A048780; AD-E200077; AFWL-TR-77-104) Avail: NTIS HC A05/MF A01 CSCL 18/5

Radioisotopic Thermoelectric/Thermodynamic Generator (RTG) systems are frequently used to power Department of Defense (DOD) and National Aeronautics and Space Administration (NASA) satellites. The launch of RTGs dictates that the user agency assure the Interagency Nuclear Safety Review Panel that risks to the populace are minimal and exposures below acceptable levels for any logically conceivable accident scenario and environment. Each agency (Energy Research and Development Administration (ERDA), NASA, and the DOD) participating on the panel performs an independent safety evaluation of the system under review and recommends action for the RTG Contractor's Safety Analysis Report. Typical techniques and results are discussed. Particular attention is paid to the analyses and test results for the Multihundred Watt RTG used in the Lincoln Experimental Satellites 8 and 9 (LES 8/9). Specific details of the nuclear safety analysis of the LES 8/9 mission are set forth. Other analysis methods used and future methodology development goals are also discussed. Author (GRA)

N78-18899# Ingenieurburo G. Hopp, Munich (West Germany).
EDP NETWORK ANALYSIS FOR ELECTRONICS IN NUCLEAR RADIATION ENVIRONMENT [EDV-NETZWERKANALYSE FUER ELEKTRONIK IM KERNSTRAHLUNGSFELD]
E. Gruen, S. Knaak, R. Kossyk, and W. Renz Bonn DOKZENTBw 1977 188 p refs In GERMAN; ENGLISH summary
(Contract T/RF-22/RF-220/31041)
(BMVg-FBWT-77-13) Avail: NTIS HC A09/MF A01; DOKZENTBw DM 30

A network analysis computer program was developed for calculation of the response of an electronic circuit to nuclear radiation. This program was extended to include the following characteristics: implicit integration routines based on the backward differentiation formulas, application to subnetworks, and optimization of computer time and storage space. An application of the Radiation Effects on Network Systems (RENS) program to the platform stabilization electronics of a Leopard 2 tank is described. ESA

74 OPTICS

Includes light phenomena.

N78-18900 Rochester Univ., N. Y.
HIGH-SPEED FABRICATION OF ASPHERICAL SURFACES Ph.D. Thesis
Gih-Horng Chen 1977 176 p
Avail: Univ. Microfilms Order No. 77-25437

Precision machine reliability and engineering data rather than the intuition and experience of the skilled optician are the major factors in a three step integrated high speed process developed for fabricating aspherical optical surfaces. The required surface shape is generated at the grinding process; a lapping process is used to reduce the surface roughness to facilitate the high-speed polishing, and the polishing process is mainly employed to make the surface transparent. Aspherical surfaces can be generated in 11 minutes with the axis-descentered diamond tubular tool and polished with the ring-shaped polisher made of polyurethane embedded with CeO2. Dissert. Abstr.

N78-18901 Rochester Univ., N. Y.
DOUBLE OPTICAL RESONANCE Ph.D. Thesis
Richard Morgan Whitley 1977 200 p
Avail: Univ. Microfilms Order No. 77-25490

The response of a three-level atom irradiated by two resonant monochromatic fields was investigated in the cascade system, in which the atom undergoes a two-step excitation, from the ground state through an intermediate state to a high excited state; and in the lambda system, in which the ground state and a metastable state are being simultaneously excited to the same upper state. Each atomic transition interacts with only one of the applied fields. The only damping mechanism is radiative decay, and the atoms all have the same resonance frequencies. Equations of motion are derived from quantum electrodynamic calculations carried out in the Heisenberg picture and solved for the time evolution of the population distribution and its steady state value, as well as for the time dependence of two-time atomic correlation functions. The lattice of dressed states for a three-level atom coupled to just the two applied fields is discussed. Dissert. Abstr.

N78-18902 Rochester Univ., N. Y.
THE TWO LEVEL ATOM OF QUANTUM OPTICS Ph.D. Thesis
Krzysztof Wodkiewicz 1977 159 p
Avail: Univ. Microfilms Order No. 77-25492

A single two level atom coupled to a single mode of a quantized electromagnetic field was discussed. A new method was introduced to investigate the spectral properties of such a system. The results showed that the two level approximations of the unitarily equivalent Hamiltonians are no longer equivalent. These two different models lead to different physical predictions about the energy spectrum. In the second part the thesis systems of many two level atoms were discussed. The known instability of the ground state was discussed in the context of various approximations. It was shown that the instability can be removed if the A(2) term and the P(2) term were taken into account in the minimal coupling Hamiltonian and in the dipole Hamiltonian respectively. A close relation between this instability and the phase transitions in such systems was shown. Dissert. Abstr.

N78-18903 Yale Univ., New Haven, Conn.
THE DEVELOPMENT OF A PARALLEL-CHANNEL SPECTROGRAPHIC DETECTOR: APPLICATIONS TO RAMAN SCATTERING Ph.D. Thesis
Philip Charles Black 1977 186 p
Avail: Univ. Microfilms Order No. 77-27804

A parallel-channel detector was developed for use in visible and near infrared light scattering experiments. The design goal of obtaining quantum limited response simultaneously over 100 resolvable spectral elements was achieved. This level of performance allows a significant decrease in the time required to obtain a low light level spectrum, when compared to the acquisition times of conventional detectors. Details of the design, construction, and operating characteristics of the parallel channel detector were given, along with the results of Raman scattering measurements to determine: (1) the vibrational rotational temperature of a flame; and (2) the gas concentration profile of a gas dynamic system. Implications of these measurement techniques were discussed. Dissert. Abstr.

N78-18904 Florida Univ., Gainesville.
SIMULATION OF TRANSMISSION ELECTRON MICROGRAPHS FOR SMALL DISLOCATION LOOPS Ph.D. Thesis
Wayne David Cooper 1977 295 p
Avail: Univ. Microfilms Order No. 77-29235

Strain contrast images from infinitesimal dislocation loops under a variety of simulated experimental conditions were studied. Analysis of these images provided a better understanding of the transmission electron microscope images of small defects. A more quantitative description of the characteristics of the black white strain contrast was developed. Analysis of the image rotation for a hypothetical loop confirmed the existence of a direct relationship between the black white contrast direction and the projected loop normal and Burgers vector. A catalog of simulated images was created which illustrates the variation in image topography for dislocation loops with changes in electron

diffracting conditions. This catalog can identify loop crystallography by inspection, to evaluate and formulate rules for contrast behavior, and to determine specific imaging criteria for loop analysis.
Dissert. Abstr.

N78-18905* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MAGNIFYING IMAGE INTENSIFIER Patent
James Vine, inventor (to NASA) (Westinghouse Electric Corp., Pittsburgh) Issued 24 Jan. 1978 5 p Filed 28 Apr. 1976 Supersedes N76-23482 (14 - 14, p 1790) Sponsored by NASA
(NASA-Case-GSC-12010-1; US-Patent-4,070,574; US-Patent-Appl-SN-680958; US-Patent-Class-250-213VT; US-Patent-Class-313-94; US-Patent-Class-313-442) Avail: US Patent Office CSCL 20F

A magnetically focused image intensifier was improved to increase the usable range of magnification without degradation of image quality. The power requirements of the focusing coils are minimal. The arrangement of the focusing coils reverses the direction of the axial magnetic field distribution between the planes of the photocathode and the phosphor screen.
Official Gazette of the U.S. Patent Office

N78-18906 Northwestern Univ., Evanston, Ill.
OPTICAL DISPERSION AND ELECTRICAL TRANSPORT STUDIES OF IRON INTERCALATED ZIRCONIUM DISELENIDE Ph.D. Thesis
Mark Ted Ratajack 1977 153 p
Avail: Univ. Microfilms Order No. 77-32342

The dispersion analysis was performed by means of computer programs which analyze the spectra by both Krammers-Kronig and Lorentzian oscillator techniques. From the oscillator model it was possible to extract information regarding the effect of iron intercalation upon the bonding character of the material. The single Lorentzian oscillator strength and damping were found to increase with iron concentration. As a result, the iron intercalation was observed to increase the macroscopic effective charge and hence the ionicity of the compound. Dissert. Abstr.

N78-18907# Air Force Avionics Lab., Wright-Patterson AFB, Ohio. Electronic Technology Div.
SPECKLEGRAM DATA REDUCTION USING OPTICAL AND DIGITAL TECHNIQUES Final Report, May 1974 - Sep. 1976
Charles Richard Lane Nov. 1977 135 p refs
(AD-A048210; AFAL-TR-77-203) Avail: NTIS HC A07/MF A01 CSCL 17/8

This report describes the development of a specklegram data reduction system for automatically analyzing specklegram output. The basic design incorporates a PDP-11 minicomputer as an overall control center with various optical and electronic components interfaced to the computer. Typical data runs yielded 1-2 second turn around time for each specklegram data point and approximately 1-2 fringe resolution over a specific output halo. Author (GRA)

N78-18908# Fairleigh Dickinson Univ., Teaneck, N.J. Dept. of Physics.
DETERMINATION OF OPTICAL CONSTANTS OF PHOSPHATES, SULPHATES AND AMMONIA AND RELATED COMPOUNDS IN THE NEAR INFRARED REGION Progress Report, 15 Jun. - 15 Sep. 1977
K. D. Moeller and V. P. Tomaselli Oct. 1977 65 p
(Contract DAAK10-77-C-0121)
(AD-A048173; PR-1) Avail: NTIS HC A04/MF A01 CSCL 20/6

A discussion of absorption phenomena in the infrared (2.5 - 15 micrometers spectral region is presented). Mechanisms surveyed include the attenuation of electromagnetic waves by dielectrics and metals; molecular absorption processes; lattice vibrations in bulk and powdered dielectrics; band gap, free carrier and multiple phonon absorption in semiconductors; absorption in bulk and powdered metals; and absorption by polymeric one-dimensional conductors. Also presented is a review of quantitative methods of determining the optical constants of solids, liquids and gases and their possible sources of error. The results of quantitative absorption measurements on tri-n-butyl phosphate, polymethylmethacrylate, cellulose, polyvinyl alcohol and ureaformaldehyde are included. Author (GRA)

N78-18909# Naval Ocean Systems Center, San Diego, Calif.
LARGE-APERTURE OPTICAL MODULATOR MATERIALS. LEAD LANTHANUM ZIRCONATE TITANATE CERAMIC AND LITHIUM NIOBATE CRYSTAL SHOW PROMISE AS MODULATOR MATERIALS FOR OPTICAL TRANSMITTERS WITH UP TO 6-INCH APERTURES Final Report, Oct. 1976 - Oct. 1977
R. P. Bocker, G. M. Meana, M. A. Monahan, G. C. Mooradian, W. E. Richards, and H. F. Taylor 11 Oct. 1977 43 p refs
(ZR0111204)
(AD-A048163; NOSC-TR-165) Avail: NTIS HC A03/MF A01 CSCL 20/12

Six categories of active optical materials were found to qualify as potential large-aperture optical modulator material candidates. Two of these, the electro-optical linear Pockels lithium niobate crystals and the ferroelectric ceramic lead lanthanum zirconate titanate wafers showed real promise. Both of these satisfy the requirements of field of view, optical quality, frequency response, and economic availability, and both performed above expectations when tested in an actual optical communications test link. Interdigital lithium niobate electrodes buried on both large optical surfaces of the crystal may further reduce half-wave voltage requirements as well as arcing problems encountered in past experiments. The structural integrity of the ceramic wafer could be increased by developing a bonded version. Optical modulators of increase are structure of smaller elements. Author (GRA)

N78-18910# California Inst. of Tech., Pasadena.
ELECTROOPTIC PHENOMENA AND DEVICES IN GASES Final Technical Report, 30 Jun. 1975 - 29 Jun. 1977
Amnon Yariv 26 Sep. 1977 36 p refs
(Contract DAAG29-75-G-0191)
(AD-A048328; ARO-13090.2-P) Avail: NTIS HC A03/MF A01 CSCL 20/6

Theoretical analysis was performed on a number of problems in nonlinear optics including 3-photon mixing in gases in the presence of a dc electric field and 4-photon mixing leading to a time reversed phase conjugate wave propagation. Author (GRA)

N78-18911# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DESIGN FOR HIGH ACCURACY CRITICAL-ANGLE SUN TRANSIT SENSOR
Norman R. Trudeau and Bradford Howland 20 Oct. 1977 51 p
(Contract F19628-78-C-0002)
(AD-A048287; ESD-TR-77-272; TN-1977-39) Avail: NTIS HC A04/MF A01 CSCL 20/6

A sun transit sensor is used to detect the sun's passing a meridianal coordinate plane of the satellite. Accuracy of operation of earlier sensors is limited by curvature of the fan beams associated with the critical angle prism. A new, two-element critical angle prism assembly was described having the following properties: (a) curvature of the fan beam can be cancelled, or balanced against higher order terms, (b) reflection occurs at the interface between the glasses, (c) achromatism is possible. A sensor utilizing two such prism assemblies operating in push-pull exhibits a planar fan beam having accuracy of + or - sun latitude range of + or - 30 deg (equatorial orbit requirement), or + or - 5 arc seconds for sun latitudes of 5 deg (ecliptic orbit requirement). Equations governing the design, the choice of radiation resistant glasses, fabrication and testing will be discussed. GRA

N78-18912# Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE MOUNT PERFORMANCE OF THE SECOND GEODSS TELESCOPE Project Report
Susan N. Landon 3 Nov. 1977 30 p
(Contract F19628-78-C-0002; AF Proj. 2128)
(AD-A048745; ETS-20; ESD-TR-77-275) Avail: NTIS HC A03/MF A01 13/5

The second GEODSS telescope has an improved drive system consisting of a single DC drive motor on each axis. This arrangement should provide a stable and reliable drive system for the telescope, which is driven by incremental encoders. Measurements on the response of the telescope to computer commanded rates were therefore taken. These measurements

were made via two computer programs; one sends rate commands to the telescope, and the other monitors the resulting positions of the telescope. The results of these measurements show that this telescope responds very accurately to rate commands over the range of most interest to us: + or - 400 arc seconds per second. Data is also presented on the performance of the telescope with the Real-Time System. Specifically, the step and settle time of the telescope over a 3.7 degree field is examined. That field corresponds to the overlapped full field on the 14 inch telescope. A very satisfactory step and settle time of approximately 2 seconds has been achieved by the telescope for that case.
Author (GRA)

N78-18913# Radiation Research Associates, Inc., Fort Worth, Tex.
STUDIES IN APPLICATION OF DISCRETE ORDINATES TRANSPORT METHODS TO LIGHT TRANSPORT CALCULATIONS: PREPARATION OF MIE THEORY CROSS SECTIONS IN LEGENDRE POLYNOMIALS
Duaine Lindstrom Patrick AFB, Fla. Air Force Tech. Appl. Center 1 Sep. 1977 117 p refs
(Contract F08606-77-C-0008)
(AD-A048614; RRA-T7704; AFTAC-TR-78-1) Avail: NTIS HC A06/MF A01 CSCL 20/6

A study was performed to determine the applicability of discrete ordinates codes to the transport of light through particulates. Light is scattered with high anisotropy by particulates. This high anisotropy requires expansion in high Legendre order for accurate expression by discrete ordinates codes. Procedures for convenient and economical production of light scattering data (Mie theory) in discrete ordinates format were developed and tested. One-dimensional time-dependent discrete ordinates calculations were performed using the TDA (Time Dependent ANISN) code with a simple cloud model. Computer storage and time limitations are outlined. Extension to largest particle sizes and a second space dimension can best be accomplished using asymmetric discrete angle sets to conserve computer resources. Further economies might be accomplished by normalization of low-order data for problems dominated by multiple scattering. Relaxation of the need to express data in Legendre series could offer further economy, but may require significant development.
Author (GRA)

N78-18914# RCA Government and Commercial Systems, Burlington, Mass. Automated Systems Div.
COMMON MODULE ELECTRO OPTICAL MULTIPLEXER DEVELOPER Final Report, 22 Jun. 1976 - 28 Feb. 1977
J. J. Klein, L. Arlan, R. C. DeMeo, and R. G. Spiecker Jul. 1977 60 p
(Contract DAAG53-76-C-0184)
(AD-A048484; CR-77-588-009) Avail: NTIS HC A04/MF A01 CSCL 17/8

The output imagery of parallel scan, modular FLIR systems is commonly viewed through an ocular or biocular eyepiece. For system applications requiring serial video for remote imagery or automatic tracking, parallel to serial multiplexing is required. A militarized 1 in. silicon television camera compatible with projected modular systems has been developed with extensive use of hybrid circuitry. The camera weight and volume are reduced to 2.0 Kg and 1600 cu. cm. and the total required input power is less than 8 watts to minimize the internal temperature rise and power source requirements. Automatic black level and gain control circuitry are provided, thereby insuring that the darkest and lightest scene elements are displayed at full contast. Camera outputs are EIA Standard RS-343-A composite video, unregulated non-composite video and vertical sync. The unregulated video is suitable for external generation of IR level and gain control signals and the vertical sync pulse useful for camera/IR scanner synchronization. Performance and test data are discussed and design features are highlighted.
Author (GRA)

N78-18915# Technische Hogeschool Twente, Enschede (Netherlands). Afdel. der Elektrotechniek.
ON THE POSSIBILITIES OF ON-LINE IMAGE RESTORATION BY MEANS OF A FINITE IMPULSE RESPONSE FILTER Ph.D. Thesis
Rindert Schutten 18 Aug. 1977 163 p refs
(THT-TM-77-020) Avail: NTIS HC A08/MF A01

In order to restore blurred images in a video system on-line, the design of (digital) two-dimensional, finite impulse response filters was investigated. With respect to the computation time, the maximum extension is limited to 9 by 9 elements. Linear restoration filters normally possess an infinite impulse response. In the case of a spatially invariant, circular symmetric blur function, the frequency transfer function (ftf) of an infinite impulse response filter was approximated in a weighted mse sense by the ftf of a finite impulse response filter. A program was developed to compute these finite impulse responses. The truncation of the impulse response elements is performed by a special designed algorithm to keep the truncation error small. From the results of the approximations it can be concluded that in general restoration filters can be approximated well, in some cases even for a smaller number of impulse response elements then 9 by 9. In an experiment with subjects, which restoration filters perform optimal restorations was investigated with respect to the subjective image quality.
Author (ESA)

N78-18916# Systems and Informatics, AG, Zug (Switzerland).
DESIGN STUDY OF A SERIAL DIGITAL INTERFACE BASED ON FIBER OPTICS
Peter Surland, Tom Linden, Vladimir Ostoich (Tech. Univ. of Den., Lyngby), and Palle Jeppesen (Tech. Univ. of Den., Lyngby) Paris ESA Nov. 1976 133 p ref
(Contract ESA-771/75-AR-SC)
(ESA-CR(P)-1008) Avail: NTIS HC A07/MF A01

The study and design of a high speed serial digital data transmission system employing optical fibers as the medium for transmitting information is presented. A number of different concepts were analyzed and a blocked immediate transmitting system type was selected and is presented in a designed form.
Author (ESA)

N78-18917# Oxford Univ. (England). Engineering Lab.
APPLICATIONS OF QUANTUM ELECTRONICS. PART 1: THE SCANNING OPTICAL MICROSCOPE Progress Report, 1975
R. Kompfner, C. J. R. Sheppard, D. Walsh, A. Choudhury, J. N. Gannaway, and P. G. Hale 1977 55 p refs 3 Vol.
(Contract SRC-B/RG/64915)
(OUEL-1183/77-Pt-1) Avail: NTIS HC A04/MF A01

A scanning optical microscope which uses a finely focused laser beam to scan the specimen in a sense of parallel lines is described. Among the aspects discussed in detail are the scanning technique, resolution and contrast enhancement, harmonic radiation, thermal consideration, and signal processing and display. Experimental results are also reported.
ESA

N78-18918# Oxford Univ. (England). Engineering Lab.
APPLICATIONS OF QUANTUM ELECTRONICS. PART 2: THE METAL COATING OF OPTICAL FIBRES Progress Report, 1975
R. Kompfner, C. J. R. Sheppard, D. Walsh, A. Choudhury, J. N. Gannaway, and P. G. Hale 1977 27 p refs 3 Vol.
(Contract SRC-B/RG/64915)
(OUEL-1184/77-Pt-2) Avail: NTIS HC A03/MF A01

The reason for coating optical fibers are reviewed; these include fiber surface protection, fiber strengthening and stiffening, and magnetic field deflection. Various methods of metal coating fibers are also summarized including evaporation, sputtering, molten metal bath, electrodeposition, and chemical techniques. Experiments using these methods are briefly described.
ESA

N78-18919# Oxford Univ. (England). Engineering Lab.
APPLICATIONS OF QUANTUM ELECTRONICS. PART 3: HOLOGRAPHIC COUPLERS FOR OPTICAL FIBRE BUNDLES Progress Report, 1975
R. Kompfner, C. J. R. Sheppard, D. Walsh, A. Choudhury, J. N. Gannaway, and P. G. Hale 1977 54 p refs 3 Vol.
(Contract SRC-B/RG/64915)
(OUEL-1185/77-Pt-3) Avail: NTIS HC A04/MF A01

A holographic coupler for optical fibers uses a holographic lens to focus light from one fiber to another. The hologram is exposed with the fibers in position, and a transverse displacement of the hologram does not affect coupling efficiency. The advantage of the method is that a single hologram can focus the light independently between a large number of pairs of fibers.

Appendixes cover volume phase gratings, diffraction theory for hologram reconstruction, and dynamical theory of diffraction for holograms. ESA

N78-18920# Oxford Univ. (England). Engineering Lab.
THE SCANNING OPTICAL MICROSCOPE
C. J. R. Sheppard 1977 14 p refs Sponsored by Sci. Res. Council
(OUEL-1220/77) Avail: NTIS HC A02/MF A01

A new microscope, in which the specimen is examined by a fine laser spot scanning over the specimen in a series of parallel lines, is described. This technique exhibits improvements over conventional optical microscopes in resolution, contrast, and depth of focus. The scanning optical microscope is particularly useful in biological and electronic studies. Author (ESA)

N78-18921# National Physical Lab., Teddington (England). Div. of Mechanical and Optical Metrology.
POLARIZED LIGHT: DEFINITIONS AND NOMENCLATURE
R. J. King Jul. 1977 22 p refs
(NPL-MOM-25) Avail: NTIS HC A02/MF A01

The effects of polarization on photometric and radiometric characteristics of materials are discussed with a view to uniformity in definitions and nomenclature. Polarizers, retarders, crystal optics, optical activity, dichroism, magneto-optic and electro-optic effects, photoelastic effects and polarization effects on reflection are analyzed and defined. ESA

N78-19037*# Hughes Aircraft Co., Culver City, Calif.
TORQUE-WHILE-TURNAROUND SCAN MIRROR ASSEMBLY
Charles John Starkus *In* NASA. Goddard Res. Center The 11th Aerospace Mech. Symp. Apr. 1977 p 111-120 refs (For availability see N78-19026 09-99)
Avail: NTIS HC A11/MF A01 CSCL 20F

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N78-18922 Maryland Univ., College Park.
DIAGNOSIS OF A RELATIVISTIC NONNEUTRAL PLASMA COLUMN BASED ON THE SYNCHROTRON RADIATION SPECTRUM, THEORY AND EXPERIMENT Ph.D. Thesis
George Dimitrios Tsakiris 1976 262 p
Avail: Univ. Microfilms Order No. 77-26548

The synchrotron radiation spectrum and the equilibrium properties of a relativistic electron plasma confined in a magnetic mirror were studied theoretically and experimentally. The incoherent synchrotron radiation spectrum is calculated for a relativistic low density plasma column that rotates about an axis of symmetry aligned parallel to a uniform magnetic field. A parameter study shows that the equilibrium and emission properties of the plasma column exhibit a sensitive dependence on the canonical angular momentum spread. Experimentally, a fast spectrum analyzer capable of sweeping the range of 12.4 to 18.0 GHz in 600 micron sec was used to measure the synchrotron radiation spectrum produced by the electrons confined in the magnetic mirror. The analyzer records a complete spectrum in a short enough interval of time that the confining magnetic field can be regarded as constant. Dissert. Abstr.

N78-18923 Yale Univ., New Haven, Conn.
EVOLUTION OF A TEST PARTICLE DISTRIBUTION FUNCTION IN A PARTIALLY IONIZED PLASMA Ph.D. Thesis
Tony Sui-Tsan Hsu 1977 79 p
Avail: Univ. Microfilms Order No. 77-27813

An experiment conceived to observe the evolution of the energy distribution of a selected group of electrons as they interact with a background plasma through electron-electron, electron-ion, and elastic electron-neutral collision was outlined. The plasma used was the after glow of a pulsed microwave discharge. The test particles were injected into the plasma as a feeble quasi monoenergetic beam. The dynamic friction and smaller diffusion in velocity were determined by Coulomb collisions. Thus in a boundary layer of the order lambda in thickness the incident well collimated beam was rendered almost isotropic in velocity space. As this distribution advanced gradually along the the discharge, it was shifted downward in mean energy due to dynamic friction, and broadened because of the distribution of friction path lengths, and because of diffusion inenergy. Dissert. Abstr.

N78-18924 Wisconsin Univ., Madison.
A POLOIDAL DIVERTOR MODEL FOR TOKAMAK FUSION REACTORS Ph.D. Thesis
Allan Tate Mense 1977 264 p
Avail: Univ. Microfilms Order No. 77-19722

The effects of an electrostatic sheath at the particle collector plates were incorporated into plasma transport equations used to simulate the particle collection effects of a divertor. The entire coupled set of time dependent, nonlinear, particle and energy transport equations were solved numerically using a differentiating algorithm and a linearization scheme. The fusion reactor plasmas investigated were assumed to have transport properties characterized by the so-called dissipative trapped particle models. The cross field transport in the divertor zone was taken to be Bohm. Dissert. Abstr.

N78-18925 Florida Univ., Gainesville.
A STUDY OF STARK BROADENING OF HIGH-z HYDROGENIC ION LINES IN DENSE HOT PLASMAS Ph.D. Thesis
Richard Joseph Tighe 1977 257 p
Avail: Univ. Microfilms Order No. 77-29288

The broadening effects produced by the ions present in the plasma were treated through the use of static electric microfield distribution functions. The microfield distribution functions employed have the following properties: (1) the radiating hydrogenic ion may have any net charge; (2) the perturbing ions and electrons in the plasma may have different kinetic temperatures; and two species of ions, may be present in any given ratio. Electron broadening effects were treated by the second order relaxation theory. Effects upon the electron perturbers due to the fact that the radiator was highly charged were included through the use of Coulomb wave functions for the perturbing electrons. The present work makes extensions needed for the calculation of line profiles from higher Lyman series members. A cutoff procedure was employed to simulate the effects due to correlations among the electron perturbers. Dissert. Abstr.

N78-18926 Tennessee Univ., Knoxville.
REFLECTION AND ABSORPTION OF ION-ACOUSTIC WAVES IN A PLASMA DENSITY GRADIENT Ph.D. Thesis
Osamu Ishihara 1977 60 p
Avail: Univ. Microfilms Order No. 77-27667

The experimental study of ion acoustic waves indicates that sometimes they are reflected and sometimes absorbed by discharge tube walls. Theoretical computation revealed that a velocity gradient produced by a density gradient plays a significant role in the reflection. The velocity gradient produced the subsonic-supersonic transition and long wavelength waves were reflected before reaching the transition, while short wavelength waves penetrated over the transition and were absorbed in the supersonic flow plasma. Dissert. Abstr.

N78-18927*# National Aeronautics and Space Administration, Washington, D. C.
VOLUME DISCHARGE IN A GAS, EXCITED BY AN ELECTRON BEAM UNDER CONDITIONS OF NONUNIFORM IONIZATION
O. B. Evdokimov, G. A. Mesiats, and V. B. Ponomarev Mar. 1978 27 p refs Transl. into ENGLISH from Fiz. Plazmy (USSR), v. 3, Mar. - Apr. 1977 p 357-364 Original language document was announced as A77-37225 and A78-14525 Transl. by Sci. Transl. Serv., Santa Barbara, Calif. Original doc. prep. by Tomsk Polytech. Inst. (USSR)
(Contract NASw-2791)
(NASA-TM-75231) Copyright. Avail: NTIS HC A03/MF A01 CSCL 20I

Volume discharge in gases excited by electron beams is

discussed. The steady state electric field distribution is derived. The voltage-current and energy characteristics are described.
Author

N78-18928# Nagoya Univ. (Japan). Inst. of Plasma Physics.
SOLITON AND GENERATION OF CLOUD IN NONLINEAR DISPERSIVE MEDIA WITH WEAK DISSIPATION
Shinsuke Watanabe Dec. 1977 26 p refs
(IPPJ-312) Avail: NTIS HC A03/MF A01

Propagation of solitons (solitary waves) in a nonlinear dispersive and weakly dissipative medium is investigated by numerical analyses of Korteweg-de Vries equation with a dissipation term. The amplitude of an initial soliton decreases and its velocity slows down as it propagates in such a system. At the same time, a non-soliton part, the cloud, is generated on the tail of a soliton. The shape of a cloud is determined by the structure of a dissipation term. An overtaking collision of two solitons is also examined numerically. Author

N78-18929# Nagoya Univ. (Japan). Inst. of Plasma Physics.
WAVE TRAJECTORY AND ELECTRON CYCLOTRON HEATING IN TOROIDAL PLASMAS
T. Maekawa, S. Tanaka, Y. Terumichi, and Y. Hamada Dec. 1977 17 p refs
(IPPJ-313) Avail: NTIS HC A02/MF A01

Wave trajectories propagating obliquely to magnetic field in toroidal plasmas are studied theoretically. Results show that the ordinary wave at appropriate incident angle is mode-converted to the extraordinary wave at first turning point and is further converted to the electron Bernstein wave during passing a loop or a hooked nail curve near second turning point and is cyclotron-damped away, resulting in local electron heating, before arriving at cyclotron resonance layer. Author

N78-18930# Nagoya Univ. (Japan). Inst. of Plasma Physics.
NON-STOCHASTIC HEATING OF MAGNETIZED PLASMA BY ELECTROSTATIC WAVE
Ryo Sugihara and Yukio Midzuno Dec. 1977 19 p refs
(IPPJ-314) Avail: NTIS HC A02/MF A01

When an electrostatic wave is suddenly applied, initially trapped particles suffer a rapid, large acceleration as well as the stochastic heating, while initially untrapped particles suffer only the stochastic heating. When the bounce frequency is larger than (omega sub c omega)/2, the initially trapped particles mainly absorb the wave energy and form a high energy trail. The results are applied to the problem of energetic ion creation in laser fusion plasma. Author

N78-18931# Nagoya Univ. (Japan). Inst. of Plasma Physics.
A PERTURBATION EXPANSION FOR THE NONLINEAR SCHRODINGER EQUATION WITH APPLICATION TO THE INFLUENCE OF NONLINEAR LANDAU DAMPING
J. Weiland, Y. H. Ichikawa, and H. Wilhelmsson Dec. 1977 28 p refs
(IPPJ-315) Avail: NTIS HC A03/MF A01

The Bogoliubov-Mitropolsky perturbation method has been applied to the study of a perturbation on soliton solutions to the nonlinear Schrodinger equation. The results are compared to those of Karpman and Maslov using the inverse scattering method and to those by Ott and Sudan on the KdV equation.
Author

N78-18932# Nagoya Univ. (Japan). Inst. of Plasma Physics.
INTERCONNECTED LINEAR THETA PINCHES
Amiya K. Sen Dec. 1977 13 p refs
(IPPJ-316) Avail: NTIS HC A02/MF A01

Several closed configurations consisting of interconnected linear theta pinches are proposed which may considerably reduce their end losses. Author

N78-18933# Nagoya Univ. (Japan). Inst. of Plasma Physics.
OPTICAL ESCAPE FACTORS FOR DOPPLER PROFILES IN SPHERICAL, CYLINDRICAL AND PLANE PARALLEL GEOMETRIES
Masamoto Otsuka Dec. 1977 22 p refs
(IPPJ-317) Avail: NTIS HC A02/MF A01

Optical escape factors for Doppler profiles in spherical, cylindrical and plane parallel geometries are tabulated over the range of optical depths from 0.001 to 100,000. Relations with the known formulae are discussed also. Author

N78-18934# Nagoya Univ. (Japan). Inst. of Plasma Physics
A SCALING LAW FOR HIGH DENSITY TOKAMAKS AND ITS APPLICATION TO JIPP T-2 DEVICE
Sanae Inoue, Kimitaka Itoh, and Yoshinosuke Terashima Dec. 1977 39 p refs
(IPPJ-318) Avail: NTIS HC A03/MF A01

A scaling law for high density and high current Tokamaks is presented on the basis of the nonlocal theory of drift instability of current carrying plasma with the assumption of quasi-linear saturation level. It is shown that the energy confinement time scales as tau sub E varies directly as ng/stquare root of T (n and T are the averaged density and temperature) due to the pure current driven mode in the relatively lower density region and tau sub E varies directly as B/square root of n (B is the toroidal magnetic field) due to the usual collisional drift instability in the higher density region. The effects of the trapped particles are assumed to be negligible. A test experiment of the scaling law on the J.I.P.P. T-II device where both the Tokamak operation and the operation with the superposition of helical fields are possible, is proposed. Author

N78-18935# Nagoya Univ. (Japan). Inst. of Plasma Physics.
MODULATED LANGMUIR WAVES AND NONLINEAR LANDAU DAMPING
Nobuo Yajima (Kyushu Univ., Fukuoka, Japan), Masayuki Oikawa (Kyushu Univ., Fukuoka, Japan), Junkichi Satsuma (Kyoto Univ., Japan), and Cusei Namba Jan. 1978 27 p refs
(IPPJ-319) Avail: NTIS HC A03/MF A01

The nonlinear Schrodinger equation with a nonlocal-nonlinear term, which describes modulated Langmuir waves with the nonlinear Landau damping effect, is solved by numerical calculations. The effects of nonlinear Landau damping on solitary wave solutions are studied. The results show that the solitary waves deform in an asymmetric way changing its velocity. The time evolutions of a periodic modulation are also explored.
Author

N78-18936# Los Alamos Scientific Lab., N. Mex.
DEVELOPMENT OF CRYOGENIC TARGETS FOR LASER FUSION
E. R. Grilly 1977 14 p refs Presented at Cryogenic Eng. Conf., Boulder, Colo., 2 Aug. 1977
(Contract W-7405-eng-36)
(LA-UR-77-1523; Conf-770801-19) Avail: NTIS HC A02/MF A01

Cooling of cryogenic targets was done by a high conductivity fiber attached at one end to a glass shell. This method was superior to the cold helium stream, it provided better control over the condensate. By employing this method no gas was allowed to spoil vacuum or interface with the plasma, and thermal radiation shields could be omitted. J.C.S.

N78-18937# Oak Ridge National Lab., Tenn.
ATOMIC REACTIONS IN VERY HIGH TEMPERATURE PLASMAS
D. H. Crandall 1977 8 p refs Presented at 3d Intern. Symp. on Plasma Chem., Limoges, France, 13 Jul. 1977
(Contract W-7405-eng-26)
(CONF-770721-1) Avail: NTIS HC A02/MF A01

Some examples of atomic related research to the fusion energy program were described. An overall spectrum of radiation from ORMAK in the 40 to 70 A range was shown. Power losses through impurities were discussed. Author

N78-18938# Princeton Univ., N. J. Plasma Physics Lab.
ELECTRON NUMBER DENSITY MEASUREMENT BY RUBY LASER INTERFEROMETRY IN A CO2 LASER-INDUCED GAS BREAKDOWN PLASMA
T. K. Chu, L. C. Johnson, and J. J. Schuss 1977 6 p Presented at the 11th Intern. Symp. on Shock Tubes and Waves, Seattle, 11 Jul. 1977
(Contract EY-76-C-02-3073)
(CONF-770725-1) Avail: NTIS HC A02/MF A01

A pulsed ruby laser beam with 3 nsec full width at half magnitude is used to obtain space- and time-resolved, two-

dimensional interferometic measurements of electron number density in CO laser produced plasma in hydrogen near the focal spot. The focal plane of the CO laser is arranged to be at the exit of a free-expansion jet, with the beam incident from the vacuum side. Several nanoseconds after breakdown, a shock wave is formed, propagating transverse to the incident laser beam direction. Behind the transverse propagating shock is an on axis density minimum, which results in laser beam self trapping. During the initial pulse duration of the CO2 laser, the radial boundary of the plasma column increases linearly in time. ERA

N78-18939# Princeton Univ., N. J. Plasma Physics Lab.
BOLTZMANN EQUATION INTEGRATION IN THERMIONIC CONVERTER CONDITIONS. PART 2: TERMS IN BOLTZMANN EQUATION
M. L. Stoenescu Jun. 1977 60 p
(Contract EY-76-S-02-2798)
(PPPL-1346-Pt-2) Avail: NTIS HC A04/MF A01

The terms in Boltzmann kinetic equation corresponding to elastic short range collisions, inelastic excitational collisions, coulomb interactions and electric field acceleration are evaluated numerically for a standard distribution function minimizing the computational volume by expressing the terms as linear combinations with recalculable coefficients, of the distribution function and its derivatives. The present forms are suitable for spatial distribution calculations. ERA

N78-18940# Princeton Univ., N. J. Plasma Physics Lab.
STEADY STATE RADIATIVE COOLING RATES FOR LOW-DENSITY HIGH-TEMPERATURE PLASMAS
D. E. Post, R. V. Jensen, C. B. Tarter, W. H. Grasberger, and W. A. Lokke Jul. 1977 91 p refs
(Contracts W-7405-eng-48; EY-76-C-02-3073)
(PPPL-1352) Avail: NTIS HC A05/MF A01

Steady-state radiative cooling rates, average charge states (Z), and mean square charge states (sq Z) for 47 elements with atomic number Z ranging from 2 to 92 were calculated for low-density (n/sub e/ less than 1 millon electrons/cu cm), high temperature (T = 0.002 approaches 100 keV) plasmas. The 47 elements spanning the periodic table include many materials of interest to controlled thermonuclear fusion research. The results for the radiation rates and charge states are presented graphically versus plasma temperature and in the form of least squares polynomial fits. ERA

N78-18941# Princeton Univ., N. J. Plasma Physics Lab.
ALFVEN INSTABILITY AND MICROMAGNETIC ISLANDS IN A PLASMA WITH SHEARED MAGNETIC FIELDS
J. Hsu, P. Kaw, and Liu Chen Jul. 1977 18 p refs
(Contract EY-76-C-02-3073)
(PPPL-1358) Avail: NTIS HC A02/MF A01

The normal mode equation for coupled drift and Alfven waves in a finite-beta nonuniform plasma with a sheared magnetic field is solved, in the slab geometry, to investigate the instability of slow Alfven waves. Besides having an appreciable growth rate, the instability also produces microscopic tearing of the rational surfaces which has important implications for anomalous transport. ERA

N78-18942# Columbia Univ., New York.
SURVEY OF LINEAR MHD STABILITY IN TOKAMAK CONFIGURATIONS
Masahiro Wakatani 1977 66 p refs
(Contract EY-76-S-02-2456)
(COO-2456-46) Avail: NTIS HC A04/MF A01

The stability against kink-ballooning modes in equilibria surrounded by vacuum or a layer of force free currents was considered. Internal kink modes and the relation to interchange modes were surveyed. ERA

N78-18943# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Flugfunk und Mikrowellen.
CALCULATIONS OF THE OPTICAL PROPERTIES OF LASER-INDUCED PLASMAS IN SOLID BODIES [BERECHNUNGEN DER OPTISCHEN EIGENSCHAFTEN VON LASERINDUZIERTEN PLASMEN BEI FESTKOERPERN]
F. Malota 15 Jul. 1977 49 p refs In GERMAN
(DLR-IB-551-77/6) Avail: NTIS HC A03/MF A01

In connection with the application of laser weapons and the requirements for tracking accuracy, calculations of the optical and infrared properties of a plasma produced by laser irradiation of a solid body were carried out. Calculations were also made for CO2 laser radiation at 10.6 micron. Experience obtained in the field of solving radiative transfer equations was applied to the problem. ESA

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N78-18944 Stevens Inst. of Tech., Hoboken, N. J.
A NEUTRON SCATTERING STUDY OF MONOLAYER NITROGEN FILMS Ph.D. Thesis
Walter Fanger Brooks 1977 148 p
Avail: Univ. Microfilms Order No. 77-26930

Elastic neutron scattering was used to probe the structure of the two dimensional nitrogen lattice formed at low temperatures on the basal planes of Grafoil. Transitions from ordered to disordered phases occur in the temperature range 47 to approximately 87K. Twenty-one coverages below 1.27 registered layers were investigated where registry is defined as occupation by the N2 molecules of every third hexagonal site in the graphite planes. From the dimensional profiles the nitrogen cluster size and the presence of a disordered vapor like phase were determined. Ordered phases were identified by the distinct sawtooth diffraction profile produced by two dimensional systems. The picture of the nitrogen phase diagram obtained is not fully consistent with either a traingular lattice gas or classical Van der Waals solid model of a two dimensional system.
Dissert. Abstr.

N78-18945 Illinois Univ., Urbana-Champaign.
PHASE TRANSITIONS AND CRITICAL PHENOMENA: UNIVERSALITY AND GLOBAL MULTICRITICAL PHASE DIAGRAMS FROM POSITION-SPACE RENORMALIZATION-GROUP STUDIES Ph.D. Thesis
Ahmet Nihat Berker 1977 90 p
Avail: Univ. Microfilms Order No. 77-26630

The position-space renormalization-group approach is reviewed and extended to more complicated systems and global multicritical behavior. The concept of restructuring is introduced and used to construct a transformation which maps Ising models of arbitrary spin s onto a spin-1/2 Ising model with further-neighbor and many-site interactions. The inverse critical temperatures of the spin-s Ising models on the triangular lattice are calculated using this spin-restructuring transformation and the results of Niemeijer and van Leeuwen for the critical subspace of the corresponding spin-1/2 Ising model. The unified global treatment of a phase diagram with a rich variety of transitions is illustrated: The spin-1 Ising (Blume-Emery-Griffiths-Potts) model on the square lattice with nearest-neighbor ferromagnetic exchange interactions both bilinear and biquadratic and crystal field interactions is studied.
Dissert. Abstr.

N78-18946 Washington Univ., Seattle.
LOW-ENERGY ELECTRON DIFFRACTION FROM EPITAXIAL SOLID KRYPTON LAYERS ON GRAPHITE Ph.D. Thesis
Martin Dee Chinn 1977 122 p
Avail: Univ. Microfilms Order No. 77-26807

A low energy electron diffraction apparatus for investigation of physically absorbed gases at low temperatures and pressures was described. Image intensification by a flat 75mm diameter channel electron multiplier plate permitted high resolution operation at incident electron beam currents as low as 3 x 10A to the minus 9th power. The sample holder was cooled to 30 K using cold flowing helium gas and titled for observation of the specular beam. Retarding field Auger electron spectroscopy was used to monitor substrate purity and to obtain approximate measurement of absorbate coverage. Measurements of the pressures and temperatures for two dimensional phase transitions of Kr on the (0001) plane of graphite made at pressures below

.0001 torr compared with extrapolations of volumetric isotherm measurements made at higher pressures. Dissert. Abstr.

N78-18947 Texas Univ., Austin.
THE EFFECTS OF TRANSITION LAYERS BETWEEN CVD-VANADIUM DIOXIDE FILMS AND OXIDE SUBSTRATES Ph.D. Thesis
Ronald Lee Remke 1977 68 p
Avail: Univ. Microfilms Order No. 77-29081

Vanadium dioxide thin films were made by several groups employing the coplanar structure. Using electrothermal models, the high temperature filament's static and dynamic characteristics were determined for this structure. Static infrared radiance observations and bolometric measurements indicated that these approaches were not complete and are unable to explain all of the observed phenomena. The object of this work was to review previous approaches to this problem noting conclusions and the approximations used in arriving at these conclusions. It was shown that the approximations used were correct except for those concerning uniform film properties in the film thickness dimension. Dissert. Abstr.

N78-18948 Florida Univ., Gainesville.
INVERSION LAYER CARRIER DISTRIBUTION AND CARRIER EFFECTIVE MOBILITY IN METAL-OXIDE-SEMICONDUCTOR DEVICES Ph.D. Thesis
Chih-Tien Hsing 1977 98 p
Avail: Univ. Microfilms Order No. 77-29253

The mobile carrier distribution within the inversion layer of a metal oxide semiconductor device was obtained by solving Schroedinger's equation and Poisson's equation conjunctively. The self consistent results were compared with the conventional solutions and the significance of their differences was discussed. The Boltzmann transport equation was solved for the carrier distribution from which the carrier effective mobility is calculated. Fermi-Dirac statistics were applied to the thermal equilibrium situation since the carriers are highly degenerate under strong inversion operation of the device. It was expected that better agreement between theory and experiment could be obtained if a more rigorous approach was followed. This approach was based upon the quantum transport theory with partially diffuse scattering at the interface. Dissert. Abstr.

N78-18949 California Univ., Berkeley.
ELECTRON TRANSFER AT SENSITIZED SEMICONDUCTOR ELECTRODES Ph.D. Thesis
Mark Thomas Spitler 1977 150 p
Avail: Univ. Microfilms Order No. 77-31547

Electron transfer from the excited state of sensitizing dyes to the conduction band of semiconductors were studied through photoelectrochemical techniques. The adsorption characteristics of rhodamine B and rose bengal were investigated using ZnO, ZnS, and TiO2 single crystals as substrates. Absorbance measurements of the adsorbed dye were taken as a function of the solution concentration of the dye. Adsorption isotherms and heats of adsorption were also established. Using the absorbance data, the quantum efficiency for photoinjection of electrons from rhodamine B into a ZnO electrode was determined to be .027. Electron transfer from excited rose bengal to TiO2 proceeded with a quantum efficiency of .004 independent of the pH of the electrolyte and the dye surface concentration. Dissert. Abstr.

N78-18950 Pennsylvania Univ., Philadelphia.
TWO-PHOTON ABSORPTION OF MOLECULAR CRYSTALS AND GAS Ph.D. Thesis
Ho-Nan Sung 1977 235 p
Avail: Univ. Microfilms Order No. 77-30259

Using the continuous scanning technique, the two-photon absorption of bipheny -h sub 10 and -d sub 10 neat and mixed crystals at 77K and 1.8K, naphthalene neat crystal at 77K and 1.8K, naphthalene in durene at 1.8K, and benzene -h sub 6 and -d sub 6 in gas phase was studied. The theory of the anisotropy for crystal containing more than one molecule in the unit cell is discussed as well as for K = 0 exciton levels having g total symmetry. Previous theoretical studies of two-photon anistropy in crystals have neglected the effects due to birefringence in using real representations for the incident fields. Expressions valid for anisotropic crystals are given. Dissert. Abstr.

N78-18951 Cornell Univ., New York.
RELAXATION OF THE BENDING MODE OF CARBON DIOXIDE BY VIBRATION TO ROTATION AND VIBRATION TO VIBRATION ENERGY TRANSFER Ph.D. Thesis
Peter McAllum Walsh 1977 119 p
Avail: Univ. Microfilms Order No. 78-0110

The V-T relaxation times of CH3F and mixtures of CO2 with CH4, CD4 and CH3F were measured over the temperature range 400-1000K in a shock tube using the laser Schlieren technique for measuring density gradients behind the incident shocks. A 2.7 micron m pulsed HF laser was used to excite vibrational levels of CO2 in CO2-Ar, CS2-CO2-Ar and OCS-CO1-Ar mixtures at room temperature. The de-excitations of the CO2(v1,v2) and CO2(v3) vibrational modes were followed by recording the fluorescence emitted at 15 micron m and4.3 micron m. The time dependenxe of the 15 micron m fluorescence showed an initial rise due to intramolecular energy transfer from CO2(v3) to CO2(v1,v2), followed by a slower decrease in intensity due to V-T and V-V relaxation of CO2(v1, v2). Dissert. Abstr.

N78-18952 Massachusetts Univ., Amherst.
THERMAL AND ELECTRICAL TRANSPORT MEASUREMENTS IN SINGLE CRYSTAL BERYLLIUM AT LOW TEMPERATURES Ph.D. Thesis
William Edward Nelson 1977 207 p
Avail: Univ. Microfilms Order No. 77-30611

The thermal conductivity and electrical resistivity of a beryllium single crystal were measured at 3K < or = T < or = 35 K in a longitudinal magnetic field up to 70 KG. Residual resistivity at 4K was 1.86 nano-ohm cm, and a thermal conductivity maximum of 140 watts/cmK was observed at 13.8K. Electrical resistivity data were fit using a Matthiessen type expression containing a residual and a temperature dependent term. A cu T Debye temperature dependence is observed below 35K and deviations from Matthiessen's rule are concluded to be negligible. Thermal conductivity data were fit to a standard STM expression. Thermal and electrical transport properties were also measured for OFHC copper over the same range of temperature and magnetic field to verify experimental techniques used in the beryllium experiments. Dissert. Abstr.

N78-18953*# National Aeronautics and Space Administration, Washington, D. C.
ELECTRONIC INSTABILITY AND CHANGE OF CRYSTALLINE PHASE IN COMPOUNDS OF THE V3Si TYPE AT LOW TEMPERATURE
J. Labbe and J. Friedel Feb. 1978 30 p refs Transl. into ENGLISH from J. Phys. (Paris), v. 27, no. 3-4, Mar.-Apr. 1966 p 153-165 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-2790)
(NASA-TM-75178) Avail: NTIS HC A03/MF A01 CSCL 20K

In V3Si, the V atoms form an array of dense linear chains; a tight-binding approximation in one dimension was used to describe the d electrons. The electronic energy calculated by this method was reduced when the lattice is deformed. This lead to a band type of the Jahn Teller effect, which may explain the cubic to tetragonal transition which was observed at low temperatures. The theory can be extended to other superconductors of the V3X type when X=Ga, Ge, Sn, etcetera, or NB3SN. Author

N78-18954# Santa Barbara Research Center, Goleta, Calif.
STUDY OF HgCdTe MIS TECHNOLOGY Final Report
David R. Rhiger and John D. Langan 15 Nov. 1977 83 p refs
(Contract N00173-76-C-0316)
(AD-A048224) Avail: NTIS HC A05/MF A01 CSCL 17/5

Metal-insulator-semiconductor (MIS) devices were fabricated on single-crystal HgCdTe with both 5-micrometer and 12-micrometer cutoff wavelengths. The purpose was to evaluate existing technology and identify fundamental limitations, for the application of HgCdTe to monolithic intrinsic focal plane arrays. For 12-micormeter material it was shown that interband tunneling provides such a large dark current that a MIS device cannot store charge effectively. Author (GRA)

N78-18955# Hughes Research Labs., Malibu, Calif.
SOLID PHASE EPITAXIAL GROWTH Annual Progress Report, 1 May 1976 - 30 Apr. 1977
J. A. Roth and C. L. Anderson Oct. 1977 47 p refs
(Contract N00014-75-C-0957)
(AD-A048261) Avail: NTIS HC A03/MF A01 CSCL 20/12

Low-temperature epitaxial growth of Si by the solid-phase epitaxy (SPE) process has been studied to determine the effects of contaminants upon the growth process. The major sources of process-induced contaminants in SPE have been reviewed, and methods for eliminating or minimizing these have been developed. We show that under clean conditions an evaporated (amorphous) Si film will crystallize epitaxially on a Si(100) substrate when heated to 525 C, but that the growth is very sensitive to inhibition by atmospheric contaminants. Similarly, SPE growth in the system Si/Pd2Si/Si(A) has been found to proceed very differently under clean conditions as compared to the standard processing used in previous work. This difference is tentatively attributed to affects of contaminants on the Pd2Si interlayer, not on the Si(a) film as was previously believed.
Author (GRA)

N78-18956# North Texas State Univ., Denton. Dept. of Physics.
OPTICALLY INDUCED HOT ELECTRON EFFECTS IN SEMICONDUCTORS Summary Report, 1 Sep. 1976 - 31 Aug. 1977
Arthur L. Smirl 21 Aug. 1977 206 p refs
(Contract N00014-76-C-1077)
(AD-A048194) Avail: NTIS HC A10/MF A01 CSCL 10/12

Progress is reported in using the high electric fields and the ultrashort pulses that can be derived from Nd:glass and CO2 lasers to investigate hot electron effects in semiconductors. This research is directed toward obtaining fundamental information concerning the saturable optical transmission properties and hot electron dynamics of semiconductors on a picosecond time scale and the stress and electric field biasing of the absorption properties of semiconductors under intense short pulse CO2 laser radiation.
GRA

N78-18957# Sperry Research Center, Sudbury, Mass.
MAGNETIC LPE CRYSTALLINE FILMS FOR SMALL BUBBLE DIAMETER CYLINDRICAL-DOMAIN MEMORY APPLICATIONS Interim Report, Jan. - Jun. 1977
M. Kestigian, W. R. Bekebrede, and A. B. Smith Wright-Patterson AFB, Ohio AFAL Aug. 1977 29 p
(Contract F44620-76-C-0121)
(AD-A048197; SCRC-CR-77-45; AFAL-TR-77-168) Avail: NTIS HC A03/MF A01 CSCL 09/5

Rare-earth iron garnet crystalline compositions were formulated, films deposited by liquid-phase epitaxy, and magnetic evaluation measurements performed. The results of the magnetic property experiments were used to select improved rare-earth iron garnet compositions and film deposition conditions for small-bubble-diameter magnetic memory applications. Representative results of delivered samples are given in tabular form in the appendix. During this report period, samarium thulium-, yttrium samarium thulium-, yttrium samarium lutetium-, and yttrium europium thulium gallium iron garnet films were grown and their static magnetic properties evaluated. Yttrium samarium lutetium calcium germanium iron garnet small-bubble-diameter films were prepared and evaluated for comparison of their magnetic properties. In addition to the static magnetic property experiments, dynamic measurements were performed on (LaEuTm)3 (FeGa)5O12 and (SmTm)3 (FeGal)5O12 films. Mobilities of 233 and 140 cm/sec/Oe, respectively, were determined for representative samples. These mobility figures reveal that these two small-bubble-diameter compositions would operate at a half megabit data rate.
Author (GRA)

N78-18958# Army Electronics Command, Fort Monmouth, N. J.
CHEMICALLY POLISHED QUARTZ Technical Report, Jan. 1976 - Sep. 1977
John R. Vig Nov. 1977 43 p refs
(AD-A048077; ECOM-4548) Avail: NTIS HC A03/MF A01 CSCL 11/2

Etching in a saturated solution of ammonium bifluoride is shown to be capable of producing chemically polished AT-cut quartz surfaces over a broad range of conditions. The quality of chemical polish depends primarily on the surface finish prior to etching, the depth of etch and the quality of quartz used. The speed of polishing depends primarily on the temperature of the etching bath. In an 88 degree C etching bath, starting with 3 micrometers lapped blanks, chemically polished blanks with a surface roughness of 0.1 micrometer and a roughness angle of 1 degree can be produced in 15 minutes. Starting with a finer surface finish can produce a smoother chemically polished surface. Chemically polished blanks are shown to be extremely strong. Fundamental mode 20 MHz resonators made with chemically polished natural quartz blanks showed no Q degradation with increasing depth of etch.
GRA

N78-18959# California Univ., Irvine. Dept. of Physics.
THEORY OF SURFACE POLARITONS IN n-InSb IN THE PRESENCE OF A DC CURRENT AND AN EXTERNAL DC MAGNETIC FIELD Interim Report
B. G. Martin, A. A. Maradudin, and R. F. Wallis Nov. 1977 5 p refs
(Contract N00014-76-C-0121)
(AD-A048217; Rept-77-26) Avail: NTIS HC A02/MF A01 CSCL 20/12

The dispersion relation for p-polarized surface polaritons has been obtained for n-InSb when a dc electric current is flowing parallel to the surface. An external, dc magnetic field, parallel to the surface, and perpendicular to the direction of propagation of the surface polariton, is assumed to be present. The solutions of the dispersion relation show that the presence of the magnetic field shifts the surface polariton dispersion curve with respect to the no-field curve. The inclusion of damping leads to backbending of the dispersion curves across the light line. Amplification of the surface polariton can occur for drift velocities greater than a certain critical value.
Author (GRA)

N78-18960# California Univ., Irvine. Dept. of Physics.
THEORY OF BOUND STATES ASSOCIATED WITH n-TYPE INVERSION LAYERS ON SILICON Interim Report
G. M. Kramer, B. G. Martin, and R. F. Wallis Nov. 1977 18 p refs
(Contract N00014-76-C-0121)
(AD-A048216; TR-77-9) Avail: NTIS HC A02/MF A01 CSCL 20/12

The ground state and two excited states of an electron bound to a charged impurity located at the interface between silicon and silicon dioxide have been investigated. The interface was taken to be parallel to a (001) plane and a static electric field p perpendicular to the surface was assumed. Calculations of the electron binding energies as functions of electric field were made for a bare charged impurity with screening by free carriers neglected. It was found that the binding energy increases with electric field and approaches that of the corresponding state of a two-dimensional hydrogen-like atom in the limit of infinite electric field. The case where the impurity is located within the oxide has also been investigated.
Author (GRA)

N78-18961# David Sarnoff Research Center, Princeton, N.J.
EPITAXIAL GROWTH OF SEMI-INSULATING GaAs Quarterly Status Report, 1 Jul. - 30 Sep. 1977
S. T. Jolly 30 Sep. 1977 14 p refs
(Contract N00014-77-C-0542; ARPA Order 3441)
(AD-A048466; QSR-1) Avail: NTIS HC A02/MF A01 CSCL 20/12

The objective of this program is to develop techniques for the vapor phase growth of high resistivity epitaxial layers of gallium arsenide on semi-insulating gallium arsenide substrates. A capability to grow such layers of high quality material with minimum structural defects and good surface quality for use as 'buffer' layers prior to the growth of active layers for such devices as FETs and TELDs will eliminate the device performance problems caused by poor and inconsistent substrate quality. A vapor phase reactor together with its associated gas control system has been constructed which will enable the experimental growth techniques envisaged for this program to be carried out. Preliminary test runs have been performed in order to check the system performance under 'normal' operating conditions. That is to determine reactor performance regarding quality and characteris-

tics of the material it can grow before attempting the growth of high resistivity material. GRA

N78-18245 Polish Academy of Sciences, Warsaw. Inst. of Fundamental Technological Research.
PLASTICITY OF POLYCRYSTAL
Cz. Eimer *In its* Arch. of Mech., Vol. 29, Issue 5 1977 p 687-703 refs Presented at IUTAM Colloq. EUROMECH 71, The Bulk Properties of Composite Mater., Bath, Engl. (For availability see N78-18240 09-31)
Copyright. Avail: Issuing Activity

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N78-18962 Tennessee Univ., Knoxville.
A MONTE CARLO METHOD OF SOLVING HEAT CONDUCTION PROBLEMS Ph.D. Thesis
Stanley Kenneth Fraley 1977 167 p
Avail: Univ. Microfilms Order No. 77-37656

The Monte Carlo method was demonstrated for problems involving multimedia, internal sources, fixed temperature boundary conditions, convective boundary conditions, time dependent sources, and for a coupled nuclear radiation heat conduction problem. Comparisons were made to analytical solutions when they were available or could be generated. The adjoint formulation was found to be the most suitable mode of solution for the class of problems which was considered, and therefore, the method appears to be more useful for calculating temperatures at specific points rather than temperature distributions. Dissert. Abstr.

N78-18963 North Carolina State Univ., Raleigh.
THERMODYNAMIC PROPERTIES OF U(C,N) SOLID SOLUTIONS AND DERIVED RELATIONSHIPS AMONG THERMODYNAMIC EXCESS PROPERTIES Ph.D. Thesis
Gary Singleton Sheffield 1977 130 p
Avail: Univ. Microfilms Order No. 77-29675

A series of well characterized U(C,N) solid solutions were investigated thermodynamically using an oxygen bomb calorimeter. A experimental system was designed, constructed and used for preparation and analysis of these pyrophoric materials in ultra high purity inert atmospheres. Negative heats of mixing of U C sub 1-x N sub x solid solutions over the composition range, x = 0.25 to 0.90, were observed at 298.15 K indicating a greater binding energy in the solid solution than in UC or UN. Nonequilibrium conditions were encountered with UC rich solid solutions. When this occurred, the measured lattice parameter of the solid solution was significantly lower than the expected value. The heat of formation of UN at 298.15 K was found to be -(71.02 + or - 0.79) kcal/mole and the lattice parameter was (4.8881 - or + A. A theoretical relationship between excess free energy and excess volume was derived and tested.
Dissert. Abstr.

N78-18964# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Lampoldshausen (West Germany). Inst. fuer Chemische Antriebe und Verfahrenstechnik.
EQUATIONS FOR APPROXIMATING THE THERMODYNAMIC DATA OF A HYDROGEN/OXYGEN STEAM GENERATOR
Robert H. Schmucker 1977 22 p refs In GERMAN; ENGLISH summary
(DLR-IB-456-77/9) Avail: NTIS HC A02/MF A01

A hydrogen/oxygen steam generator can be considered the essential element of a future electric power station, regardless of whether it is nuclear- or fossil-fuel powered. Hydrogen and oxygen are combusted in a burner similar to a rocket motor and the temperature of the hot gases is subsequently decreased to allow their use in a steam turbine. The thermodynamic values of the gases - temperature and characteristic velocity - are given in relation to various parameters and are represented by approximation equations in which corrections for stoichiometric deviations and the initial enthalpy are considered. The relations are applied to an experimental steam generator's flow efficiency showing the limits of a simple performance analysis. The influence of insufficient water evaporation and mixing can be predicted with these efficiency relations, and the accuracy of the prediction of the experimental steam generator efficiency can be estimated. Author (ESA)

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N78-18965# Army Materiel Development And Readiness Command, Alexandria, Va.
JOINT DESIGN-TO-COST GUIDE. LIFE CYCLE AS A DESIGN PARAMETER
15 Oct. 1977 81 p Supersedes DARCOM-P-700-6, NAVMAT-P5242 and AFLCP/AFSCP-1800-19
(AD-A048254; DARCOM-P-700-6; NAVMAT-P5242; AFLCP/AFSCP-1800-19) Avail: NTIS HC A05/MF A01 CSCL 05/1

The Design to Cost (DTC) concept establishes life cycle cost (life cycle cost to the maximum extent feasible) as a design parameter during a system's design and development phase and provides a cost discipline to be used throughout the acquisition of a system. This guide provides information and guidance for application of the Design to Cost concepts contained in DOD Directive 5000.28, Design to Cost, dated 23 May 1975 which has been included as Appendix A. The effectiveness of Design to Cost in meeting weapon systems needs within budget constraints greatly depends upon the manner in which it is implemented. This guide makes no attempt to develop a standardized approach to implement Design to Cost other than to outline certain policies and basic guidelines. Design to Cost must be tailored to fit the individual program based on stated objectives and risks involved. GRA

N78-18966# Decisions and Designs, Inc., McLean, Va.
SELECTING ANALYTIC APPROACHES FOR DECISION SITUATIONS. VOLUME 1: OVERVIEW OF THE METHODOLOGY Technical Report, 1974 - 1977
Rex V. Brown and Jacob W. Ulvila Sep. 1977 80 p refs Revised 3 Vol.
(Contract N00014-75-C-0426)
(AD-A047965; TR-77-7-25-Vol-1-Rev) Avail: NTIS HC A05/MF A01 CSCL 12/2

The three volumes of this report present a conceptual framework within which experienced decision analysts can derive generalizations that match analytic techniques to decision situations and communicate those generalizations to decision makers and inexperienced analysts. The framework consists of a three-way taxonomy: decision situations, analytic options, and performance measures. The first component is a 'situation taxonomy,' listing about one hundred dimensions of a situation that might be relevant to a particular analytic choice. These dimensions include: the stakes involved in a decision; the reaction time available; and the clarity with which options, probable consequences, and values are perceived. The second component is an analysis taxonomy, according to which about one hundred decision-analytic choices can be located in an analytic option space. Dimensions of the analytic taxonomy include: how much

decision analysis is undertaken, how it is used, what type of model structure is involved, and what technique for probability assessment or consequence evaluation is employed. The third component is a performance measure taxonomy, listing about thirty measures of effectiveness which can characterize the analytic options. The same taxonomy can also be used to describe a situation by expressing the relative importance of the performance measures in the situation. GRA

N78-18967# Decisions and Designs, Inc., McLean, Va.
SELECTING ANALYTIC APPROACHES FOR DECISION SITUATIONS. VOLUME 2: CASE STUDIES
Rex V. Brown and Jacob W. Ulvila Sep. 1977 115 p refs Revised 3 Vol.
(Contract N00014-75-C-0426)
(AD-A047880; TR-77-7-25-Vol-2-Rev) Avail: NTIS HC A06/MF A01 CSCL 12/2

The three volumes of this report present a conceptual framework within which experienced decision analysts can derive generalizations that match analytic techniques to decision situations and communicate those generalizations to decision makers and inexperienced analysts. This volume contains 5 case applications involving: (1) The problem of what foreign policy the U.S. should adopt in order to obtain more oil from a particular mideastern country; (2) A decision faced by the president of an electrical equipment company of whether to purchase the defense market rights to a flight safety patent; (3) A project undertaken by the Naval Electronics Systems Command to apply the /Design-to-Cost/ concept to an evaluation of proposed electronic warfare systems; (4) A Research and development project aimed at developing tactical decision aids for Navy task force commanders; and (5) A study aimed at predicting NATO's response to actions taken by the Warsaw Pact countries. GRA

N78-18968# Decisions and Designs, Inc., McLean, Va.
SELECTING ANALYTIC APPROACHES FOR DECISION SITUATIONS. VOLUME 3: APPENDICES
Rex V. Brown and Jacob W. Ulvila Dec. 1977 86 p Revised 3 Vol.
(Contract N00014-75-C-0426)
(AD-A048228; TR-77-7-25-Vol-3-Rev) Avail: NTIS HC A05/MF A01 CSCL 12/2

The conceptual framework consists of a 3-way taxonomy: decision situations, analytic options, and performance measures. The first component is a 'situation taxonomy,' listing about 100 dimensions of a situation that might be relevant to a particular analytic choice. These dimensions include: the stakes involved in a decision; the reaction time available; and the clarity with which options, probable consequences, and values are perceived. The 2nd component is an 'analysis taxonomy,' according to which about 100 decision-analytic choices can be located in an analytic option space.' Included are: how much decision analysis is undertaken, how it is used, what type of model structure is involved, and what technique for probability assessment or consequence evaluation is employed. The 3rd component is a performance measure taxonomy,' listing about 30 measures of effectiveness which can characterize the analytic options. Performance measure dimensions include: enhanced logical reasoning, cost, speed, convenience, and facilitated communication. This component serves as a mediating factor, in matching analysis to situation. This volume contains very detailed lists of the 3 taxonomies and matching generalizations relating 22 analytic techniques to decision situations. GRA

N78-18969# Carnegie-Mellon Univ., Pittsburgh, Pa. School of Industrial Administration.
TOWARDS A FRAMEWORK OF ORGANIZATIONAL EFFECTIVENESS Final Report, 1 Apr. 1976 - 1 Aug. 1977
Paul S. Goodman and Johannes M. Pennings 22 Dec. 1977 10 p
(Contract N00014-75-C-0973; NR Proj. 170-801)
(AD-A047966L) Avail: NTIS MF A01 CSCL 12/2

The general goal of this research was to extend our knowledge on organizational effectiveness. The topic of organizational effectiveness is critical in theoretical and applied work on organizations. The approach in this research has been to first develop a theoretical model and then to conduct some empirical research on effectiveness. GRA

N78-18970# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
AN EXPERIMENT ON EXECUTIVE DECISION MAKING
Eduard J. Fidler and Gerald L. Thompson Jul. 1977 37 p refs
(Contract N00014-75-C-0621)
(AD-A047888L; RR-407; WP-3-77-78) Avail: NTIS HC A03/MF A01 CSCL 05/3

This paper analyzes capital budgeting decisions of business executives in an experimental setting. Two different data analysis techniques, a linear programming and a maximum likelihood method, are used to analyze preference judgements for hypothetical investment projects. For each of the twenty investment projects the following information was provided: a probability distribution of returns on investment, and magnitude of the investment, the number of additional men to be hired for implementing the investment, and the expected payback period for the investment. Five conclusions are demonstrated based on two independent experiments with business executives: Mean return on investment, and payback period, are the most important investment characteristics; Upper and middle management executives have almost identical preference structures; Downside variation of the return distribution has a stronger influence on investment decisions than overall variations; Usefulness of this methodology for (1) analyzing preference judgments of individual executives; (2) training purposes; and (3) as an aid to organizational decision making; and Both data analysis techniques give highly similar conclusions. Author (GRA)

N78-18971# Naval Postgraduate School, Monterey, Calif.
TOTAL CONTRACTOR LOGISTICS SUPPORT: A NEW CONCEPT IN NAVAL AVIATION M.S. Thesis
Antonio Apap Dec. 1977 87 p refs
(AD-A048674) Avail: NTIS HC A05/MF A01 CSCL 15/5

This thesis investigates a new concept in Naval Aviation: total contractor logistics support. The Federal Government's policy of relying on the private sector for goods and services, as promulgated in OMB Circular No. A-76, is examined in depth. The history and present experiences of the military services concerning contractor aviation logistics support are outlined and discussed. The Navy's T-44A program, including the acquisition, total logistics support contract, and the Navy's experience with this first 'turn key' operation of aircraft, is discussed in depth. Finally, the major advantages and disadvantages of total contractor support in Naval Aviation are explained and analyzed.
Author (GRA)

N78-18972# Stanford Univ., Calif. Dept. of Statistics.
MANAGEMENT STRATEGIES IN FIXED STRUCTURE MODELS OF COMPLEX ORGANIZATIONS, 2
Alan E. Gelfand and Crayton C. Walker 2 Sep. 1977 42 p refs
(Contract N00014-76-C-0475; Grant DAAG29-77-G-0031)
(AD-A048789; TR-250) Avail: NTIS HC A03/MF A01 CSCL 05/1

Part I of this effort suggests that switching net models provide useful insight into the behavior of complex organizational control systems. Equivalence relations on the responses of system elements were defined, namely internal homogeneity and forcibility. These in turn were interpreted as managerial strategies: management by exception and management by priority, respectively. The present article introduces a further equivalence relation--extended threshold, which is interpreted as management by consensus. The notion of extended threshold and its interaction with internal homogeneity and forcibility are examined in detail. We then observe that organization-wide control may be exercised by varying strategy levels. Finally, we speculate as to the psychological impact of the strategies on the work force and explore implications these interpretations have for organizational climate in complex enterprises. Author (GRA)

N78-18973# National Physical Lab., Teddington (England). Div. of Quantum Metrology.
[ACTIVITIES OF THE QUANTUM METROLOGY DIVISION] Annual Report 1975
[1976] 63 p refs
(NPL-Qu-AR75) Avail: NTIS HC A04/MF A01

An account of the progress in various areas of research

including standards is given together with detailed descriptions of selected items such as the stability of austenitic stainless steels at low temperatures; international comparison of spectral irradiance scales; and ultraviolet spectral emission standards. Publications and lectures presented are also included. ESA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N78-18974 Cornell Univ., Ithaca, N. Y.
OPTIMAL DATA STORAGE AND ORGANIZATION IN COMPUTERIZED INFORMATION PROCESSING SYSTEMS SUBJECT TO FAILURES Ph.D. Thesis
Guy Maring Lohman 1977 231 p
Avail: Univ. Microfilms Order No. 77-28367

Three major ways to minimize the overall impact of failures in computerized information processing systems are presented. A model is presented in which the frequency of backup that balances the total backup and expected recovery costs is found in terms of the number of updates that have been accumulated since the last backup. Failures necessitate distributing redundant copies of data-sets to various devices. An efficient branch and bound algorithm determines how many copies to distribute and on which devices to store them statically, and thus the necessary quantity of each device. Finally, the vulnerability of a database to failures may be reduced by changing the file organization to insulate the majority of the data and its access mechanisms from all real time updating. Dissert. Abstr.

N78-18975*# National Aeronautics and Space Administration, Washington, D. C.
ACCESSING NUMERIC DATA VIA FLAGS AND TAGS: A FINAL REPORT ON A REAL WORLD EXPERIMENT Final Report, 1 Oct. 1976 - 31 Oct. 1977
James P. Kottenstette (Denver Research Inst., Colorado), James E. Freeman (Denver Research Inst., Colorado), Eileen R. Staskin (Denver Research Inst., Colorado), and Charles W. Hargrave Jan. 1978 70 p refs Prepared in part by Informatics Information Systems Co., Linthicum Heights, Md. and AIAA, N. Y.
(Contracts NASw-2992; NASw-2899; NASw-2532; Grant NSF DSI-76-05644)
(NASA-TM-79326) Avail: NTIS HC A04/MF A01 CSCL 05B

An experiment is reported which: extended the concepts of data flagging and tagging to the aerospace scientific and technical literature; generated experience with the assignment of data summaries and data terms by documentation specialists; and obtained real world assessments of data summaries and data terms in information products and services. Inclusion of data summaries and data terms improved users' understanding of referenced documents from a subject perspective as well as from a data perspective; furthermore, a radical shift in document ordering behavior occurred during the experiment toward proportionately more requests for data-summarized items. Author

N78-18976*# National Aeronautics and Space Administration, Washington, D. C.
WHAT THE NEXT DECADE IS GOING TO BRING
1977 34 p Presented at NASA STI Conf., Baltimore, 26 Oct. 1977
(NASA-TM-79361; NST-10) Avail: NTIS HC A03/MF A01 CSCL 05B

A record of a discussion among a number of the major managers of information systems within the U.S. Government is presented. The topics of discussion focus on assessing the past and present information systems with an emphasis on planning future projects to meet the changing needs of science and technology. G.Y.

N78-18977# Massachusetts Computer Associates, Inc., Wakefield.
RESEARCH ON INFORMATION SYSTEM SPECIFICATION Final Report, 1 Mar. 1976 - 31 May 1977
Anatol W. Holt 9 Aug. 1977 180 p refs
(Contract N00014-76-C-0781)
(AD-A047864; CADD-7708-0911) Avail: NTIS HC A09/MF A01 CSCL 09/4

This document reports the results of the development of methods for system specification and analysis in conjunction with the National Software Works Project currently in progress in our company. This report indicates that the ideas developed and partially tested in this setting are, potentially, of wide utility in the description and analysis of systems where the interest focuses on the relation of communication among a set of agents with interdependent tasks. There is a description of a theoretical framework in which to study the effects of the propagation of information in a system contest as a result of analysis of logical dependence relations in nets. There is a discussion of the relationship between the concepts concurrency and choice, a survey of the use of Petri-nets for the representation of organizational relations. Author (GRA)

N78-18978# Naval Underwater Systems Center, New London, Conn.
NUSC TECHNICAL PUBLICATION GUIDELINES
17 Oct. 1977 113 p refs Supersedes NUSC-TD-4498; NUSC-TD-4723
(AD-A048066; NUSC/NL-TD-5329; NUSC-TD-4498; NUSC-TD-4723) Avail: NTIS HC A06/MF A01 CSCL 05/2

This Guide is intended as a basic reference for the preparation and processing of technical reports, documents, manuals, memoranda, and brochures/pamphlets at the Naval Underwater Systems Center. It has two main purposes: (1) to establish common standards of communicating technical information for engineers and scientists at the Center's laboratories and (2) to promote a common understanding among author, editor, and reviewer of the requirements and responsibilities that each type of technical publication imposes. It also has another, less obvious, purpose: to encourage the participants to respect each other's prerogatives and to convince them of the importance of working as a team. In addition to discussing the preparation and processing of technical publications, the Guide offers numerous techniques and devices to aid the author. Author (GRA)

N78-18979# Cranfield Inst. of Technology (England).
A COMPARATIVE EVALUATION OF SEARCHING BY CONTROLLED LANGUAGE AND NATURAL LANGUAGE IN AN EXPERIMENTAL NASA DATA BASE
C. W. Cleverdon Jul. 1977 134 p refs
(Contract ESA-1/432)
(ESA-CR(P)-1009) Avail: NTIS HC A07/MF A01

An evaluation test was made of an experimental database prepared by the Space Documentation Service of the European Space Agency, consisting of some 44,000 items from NASA STAR for 1973 and 1974. With this database it was possible to search on natural language terms in the titles and abstracts, in addition to the normal searches on controlled language index terms. The on-line searches were carried out at four centers, each center being responsible for ten questions, with two searches in the alternative search modes being made by different people for each question. Up to twenty-five documents retrieved in the two searches for each question were sent to the originator of the question for relevance assessment. The results are presented in a number of different ways, but in every case the natural language searches showed a significantly higher recall ratio than the controlled language, with little difference in the precision ratios. It is suggested that the main reason for the superiority of natural language searching is the greater exhaustivity of the abstracts as compared to the indexing. Author (ESA)

N78-18980# National Physical Lab., Teddington (England). Div. of Computer Science.
AUGMENTATION OF A TEXT RETRIEVAL SYSTEM WITH AN INTELLIGENT GRAPHICS TERMINAL
Susan E. Olding Jan. 1977 23 p refs Sponsored by Computer Systems and Electron. Requirements Board
(NPL-Com-86) Avail: NTIS HC A02/MF A01

A graphics system is described which is added on to an intelligent terminal and consists of a visual display unit, a

microprocessor, and a storage tube display. The terminal is linked to the Scrapbook text retrieval system through a network. The command language, software, and applications are outlined. ESA

N78-18981# Birmingham Libraries Cooperative Mechanisation Project (England).
FILE ORGANISATION AND ACCESS TECHNIQUES. A SELECTIVE BIBLIOGRAPHY
G. N. Metcalfe Oct. 1977 150 p
(BLL-BLRDR-5414-(2113.56F); ISBN-0-903154-08) Avail: British Library Lending Div., Boston Spa, England

This bibliography results from a review of the literature of file organisation and access techniques and includes references on a wide variety of topics from introductory texts on file organisation to the design of specific search techniques. Special emphasis is placed on the use of bibliographic search keys and the searching of large files of bibliographic data. The bibliography contains 321 references, the majority of which include abstracts. The work has been carried out as part of a BLCMP research programme financed by the British Library. Author

N78-18982# British Library Lending Div., Boston Spa (England). BL Research Development Dept.
INDEXING OF STRUCTURAL DATA ON CHEMICAL COMPOUNDS IN BRITISH UNIVERSITIES Final Report, Jul. 1975 - Jun. 1977
M. B. Stevenson and A. J. Conway 1977 35 p
(BLL-BLRDR-5355-(2113.56F)) Avail: British Library Lending Div., Boston Spa, England

The report is concerned with the results of a feasibility study to investigate the viability of producing indexes of compounds produced in university chemistry departments. Present methods of storage and retrieval of samples of such compounds are haphazard and there is little enthusiasm for change. Descriptions are given of known departmental or individual collections and of the work of data collection and method of establishment of indexes for individual research groups. Active co-operation and participation of chemists is required to overcome the problems of non-standardisation of labelling of samples and errors of transcription and errors in theses. Time taken to establish an index is of the order of six to seven minutes per sample. Typically on 20% of compounds reported in theses are available as samples and nearly 20% of compounds represented in the index were not to be found reported in Chemical Abstracts. Potential advantages of an index of compounds are discussed. Author

N78-18983# British Library Lending Div., Boston Spa (England).
DEVELOPING AN ACQUISITIONS SYSTEM FOR A UNIVERSITY LIBRARY
Anthony Hindle May 1977 52 p refs
(BLL-BLRDR-5351; ISBN-0-905984-03-X) Avail: British Library Lending Div., Boston Spa, Engl.: £3.00; or $6.00

A proposed acquisition system for the Lancaster University Library would divide intended acquisitions into research-related materials (R) or teaching-related materials (T) and the acquisitions budget would be split accordingly, with the R-budget allocated between departments and the T-budget retained centrally. Intended acquisitions would fall into one or the other category; those in the T-category being tested against criteria of expected use (and possbily returned to the requester for reconsideration). Topics covered included the coding of requests in terms of intended against actual use; the effect of price, loan category and recommendation on the amount of use of books; and in-library use compared with circulation. Inter-library lending as a substitute for acquisition and the relationship between them are analyzed. The existing acquisition system at the library is analyzed. It is hoped that the results will help other universities to deal effectively with some of the problems of acquisition and collection size caused by reduced resources. Author

N78-18984# Public Libraries Research Group, Brighton (England).
THE INDEPENDENT LEARNING PROJECT: A STUDY OF CHANGING ATTITUDES IN AMERICAN PUBLIC LIBRARIES
Ronald George Surridge and Judith Bowen 1977 98 p refs
(BLL-BLRDR-5396-(2113.56F); ISBN-0-9503801-3-X) Avail: British Library Lending Div., Boston Spa, Engl.

Attitudinal changes in librarians who participated in a program planning and evaluation for research project designed to investigate the cost effectiveness of public library services in America were studied. Whereas response by users to the new service was very varied, involvement in the project had alerted librarians to a whole range of new ideas and had encouraged them to question the role of the public library in the community. At the same time it gave them the opportunity to handle a whole range of data concerning users, take-up of the service and institutional commitment to the project. Not only did they handle the data, but they themselves had been largely responsible for designing the research tools to collect it. Author

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N78-18985# Texas Christian Univ., Fort Worth. Inst. of Behavioral Research.
A NOTE ON THE DYNAMIC CORRELATION COEFFICIENT
L. R. James, C. W. Hornick, and R. G. Demaree 4 Nov. 1977 26 p refs
(Contract N00014-77-C-0125)
(AD-A047654; IBR-77-22) Avail: NTIS HC A03/MF A01 CSCL 05/3

The use of the dynamic correlation coefficient as a test of spuriousness in longitudinal designs was examined. It was shown that given conditions of spuriousness and perfect stationarity, the dynamic correlation coefficient was positively, rather than inversely, related to spuriousness. It was recommended that the dynamic correlation coefficient not be used in the future as a test of spuriousness. Author (GRA)

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N78-18986# Massachusetts Inst. of Tech., Cambridge. Sea Grant Program.
INTERNATIONAL TRANSFER OF MARINE TECHNOLOGY, A THREE-VOLUME STUDY
Judith Kildow Sep. 1977 382 p refs
(Grant NOAA-04-4-158-24)
(PB-275353/1; MITSG-77-20; NOAA-77101904) Avail: NTIS HC A17/MF A01 CSCL 05A

Conceptual and practical guidelines are presented to assist the Federal Government in establishing more effective means for sharing marine science and technology with other nations. Socio-politico-economic scientific and technical aspects, issues as well as are discussed. A hypothetical United States program in international marine science and technology is propose along with an accompanying country case study of Mexico as a possible participant. GRA

85 URTBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N78-18987 Clemson Univ., S.C.
INVESTIGATION OF MAGNETIC WATER TREATMENT DEVICES Ph.D. Thesis

Edward Aloysius Duffy 1977 176 p
Avail: Univ. Microfilms Order No. 77-29689

Pretreatment of feed water with physical devices which utilize magnetic fields significantly reduce the amount of CaCO3 scale formed on the walls of heat exchangers and boilers. The following effects were investigated: (a) magnetic fields on the components of the scale forming system; i.e., water, CO2, Ca(HCO3)2, and Fe(OH),; (b) commercial magnetic devices on the formation of CaCO3 scale in a laboratory sized heat exchanger; (c) iron ions on the qualitative and quantitative formation of CaCO3 scale; and (d) magnetization on the rate of corrosion of iron. Although commercial magnetic devices did not affect CaCO3 scale formation, the addition of Fe(OH)3 to the feed water did significantly affect scale formation but then only at low temperatures where calcite was the favored allotropic crystalline form of CaCO3. The effect was directly related to iron ion concentration and inversely related to the temperature of scale formation. Magnetization was found to increase the corrosion rate of iron. Dissert. Abstr.

N78-18988*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STATE-OF-THE-ART ASSESSMENT OF ELECTRIC VEHICLES AND HYBRID VEHICLES
Sep. 1977 595 p refs
(Contract EC-77-A-31-1011)
(NASA-TM-73756; CONS/1011-1; E-9308) Avail: NTIS HC A25/MF A01 CSCL 13F

The Electric and Hybrid Vehicle Research, Development, and Demonstration Act of 1976 (PL 94-413) requires that data be developed to characterize the state of the art of vehicles powered by an electric motor and those propelled by a combination of an electric motor and an internal combustion engine or other power sources. Data obtained from controlled tests of a representative number of sample vehicles, from information supplied by manufacturers or contained in the literature, and from surveys of fleet operators of individual owners of electric vehicles is discussed. The results of track and dynamometer tests conducted by NASA on 22 electric, 2 hybrid, and 5 conventional vehicles, as well as on 5 spark-ignition-engine-powered vehicles, the conventional counterparts of 5 of the vehicles, are presented. Author

N78-18989*# National Aeronautics and Space Administration, Washington, D. C.
PASSENGERS IN CONTAINERS
V. Tarkhanovskiy Dec. 1977 7 p Transl. into ENGLISH from Sots. Industriya (USSR), 21 Apr. 1977 p 4 Transl. by Transemantics, Inc., Washington, D. C.
(Contract NASw-2792)
(NASA-TM-75078) Avail: NTIS HC A02/MF A01 CSCL 05H

A futuristic vision of future passenger and cargo transport is presented. To speed up lengthy transit operations, passengers would be accomodated in comfortable, compartment-like containers. Several diagrams show how such containers can be accomodated aboard an aircraft or a helicopter, on a truck, or in a railroad car. A system would result in great economy in both cost and time. Of particular importance is such a system for cargo traffic. Author

N78-18990# Public Technology, Inc., Washington, D. C. Information Systems Group.
HUD/PTI INFORMATION SYSTEMS IMPROVEMENT PROGRAM. CHIEF EXECUTIVE'S OVERVIEW Final Report
1977 80 p
(Contract HUD-H-2106R)
(PB-274207/0; HUD-RES-1187) Avail: NTIS HC A05/MF A01 CSCL 13B

An overview containing information which should help a jurisdiction decide whether or not to enter into an improvement program is presented. Relevant information systems concepts, program organization and operations, and the various factors involved when evaluating the costs and benefits of a formal improvement program were evaluated. GRA

N78-18991# Environmental Quality Systems, Inc., Rockville, Md.
INFORMATION AND TECHNOLOGY TRANSFER PROGRAM FOR THE NATIONAL SCIENCE FOUNDATION
May 1977 30 p refs
(Grant NSF ENV-76-18492)
(PB-274259/1; NSF/RA-770285) Avail: NTIS HC A03/MF A01 CSCL 05B

The specific components of this study include: a review of the present technical outputs of the Chemical Threats to Man and the Environment (CT) Program; a systematic categorization of all the users of the CT program and the various information transfer mechanisms used to reach this audience; and the development of lists of users in each category detailed down to the cognizant organization in the unit. This report incorporates the products of all tasks into a format which helps guide the utilization of research results. A program is suggested to help coordinate delivery of information to the hierarchy of users identified as beneficiaries of the program. GRA

N78-18992# Dallas Dept. of Water Utilities, Tex.
WASTEWATER CHARACTERIZATION AND PROCESS RELIABILITY FOR POTABLE WASTEWATER RECLAMATION
Albert C. Petrasek (Texas A and M Univ., College Station) Nov. 1977 127 p refs
(Grant EPA-R-803292)
(PB-274874/7; EPA-600/2-77-210) Avail: NTIS HC A07/MF A01 CSCL 13B

The reliability of individual unit processes was evaluated and the effects of process instability on product water-quality were investigated. The sequence of unit processes used to treat municipal wastewater consisted of screening, degritting, primary clarification, biological treatment with completely-mixed activated sludge, high-pH lime coagulation, single-stage recarbonation with liquid carbon dioxide, gravity filtration, and two-stage activated carbon adsorption. GRA

N78-18993# Oxford Univ. (England). Engineering Lab.
SYNTHESIS OF SEQUENCES FOR TRAFFIC SIGNAL CONTROLLERS USING TECHNIQUES OF THE THEORY OF GRAPHS Ph.D. Thesis
Isabel Maria SantosNevesZuzarteTully 1977 171 p refs
Sponsored by Inst. de Alta Cultura, Port.
(OUEL-1189/77) Avail: NTIS HC A08/MF A01

Increasing traffic on the road systems demands additional efforts in the optimization of traffic signals. Studies show that the choice of sequence is of considerable importance in minimizing total delay rate. This delay rate minimization is subject to various restraints expressing safety, logical necessity, and the management policies for the individual traffic streams. The simple general form of such restraints is elucidated and a method for finding the minimum cycle time consistent with an arbitrary set of restraints on a general sequence is presented. An initial computer program for this method shows it to be very efficient and useful to screen sequences before the more difficult and laborious calculation of minimized delay rate. The mathematical and conceptual analysis employed in obtaining the results depends heavily on the mathematical theory of graphs. Author (ESA)

N78-18994# Public Technology, Inc., Washington, D. C. Information Systems Group.
HUD/PTI INFORMATION SYSTEMS IMPROVEMENT PROGRAM. AN ORIENTATION TO COMPREHENSIVE INFORMATION SYSTEMS IMPROVEMENT FOR A LOCAL GOVERNMENT Final Report
1977 256 p refs
(Contract HUD-H-2106R)
(PB-274177/5; HUD-RES-1175) HC A12/MF A01 CSCL 13B

The series was developed as an aid to local administrators who want to improve their planning, management, and operations by improving their information, the system that produces it, the technologies used in processing it, and the effectiveness with which it is used. The Orientation and Training volume discusses the need for various types of orientation and training in relation to a comprehensive program to improve such systems, identifies different categories of recipients, discusses factors for condideration in estimating requirements, and presents a training methodology together with the forms that may be used in the training process. GRA

N78-18995# Public Technology, Inc., Washington, D. C. Information Systems Group.
HUD/PTI INFORMATION SYSTEMS IMPROVEMENT PROGRAM: TRANSFER ANALYSIS METHODOLOGY GUIDE Final Report
1977 79 p
(Contract HUD-H-2341)
(PB-274178/3; HUD-RES-1181) Avail: NTIS HC A05/MF A01 CSCL 13B

The guide is directed toward management level people in local government and is intended to help them plan and carry out the successful transfer of automated systems. The guide includes the organization and management of a transfer project, initial problem analysis, evaluation of the system to be transferred, assessing system and organizational differences, implementation, costs, and ingredients of successful transfer. GRA

N78-18996# Public Technology, Inc., Washington, D. C. Information Systems Group.
HUD/PTI INFORMATION SYSTEMS IMPROVEMENT PROGRAM. PLANNING AND MANAGEMENT: A METHODOLOGY GUIDE Final Report
1977 116 p
(Contract HUD-H-2106R)
(PB-274179/1; HUD-RES-1182) Avail: NTIS HC A06/MF A01 CSCL 13B

The establishment of an Information Systems Improvement Program in local government is discussed. A planning and management report with four interrelated sections is presented. A background briefing on relevant management and system building concepts, and discussions of program organization and operation were provided. Various factors involved when managing component projects within the program were also discussed. Author

N78-18997# Public Technology, Inc., Washington, D. C. Information Systems Group.
HUD/PTI INFORMATION SYSTEMS IMPROVEMENT PROGRAM: INFORMATION SYSTEMS ANALYSIS METHODOLOGY GUIDE Final Report
1977 162 p
(Contract HUD-H-2106R)
(PB-274180/9; HUD-RES-1183) Avail: NTIS HC A08/MF A01 CSCL 13B

A series dealing with the establishment of an information systems improvement program in local government is reported. The systems analysis methodology guide can be used by local government personnel to study a broad range of information-related problems in their jurisdiction. The techniques presented can be applied to small manual-system problems or to large computer-based information systems. The guide provides a background and perspective for an information systems analysis project, project management requirements, and information on the tasks involved when executing the analysis methodology. GRA

N78-18998# National Academy of Sciences - National Research Council, Washington, D. C. Committee on a Multimedium Approach to Municipal Sludge Management.
MULTIMEDIUM MANAGEMENT OF MUNICIPAL SLUDGE, VOLUME 9
Oct. 1977 218 p refs
(Contract EPA-68-01-2430)
(PB-274093/4) Avail: NTIS HC A10/MF A01 CSCL 13B

Ecological, technical, economic, and social data on which regulatory decisions for sludge management are founded; legal and institutional constraints on EPA; research on sludge management were examined. While primarily addressing the final stages of the wastewater treatment system as it applies to sludge treatment and disposal or reuse, the potential for lowering the concentration of metals and other toxic materials in sludge through source control and pretreatment of industrial wastes was studied. GRA

N78-18999# District of Columbia Dept. of Environmental Services, Washington, D.C.
DIGITAL COMPUTER CONTROL OF ADVANCED WASTE TREATMENT SYSTEMS Final Report, Dec. 1972 - Dec. 1974
Robert Yarrington, Walter W. Schuk (Municipal Environ. Res. Lab., Cincinnati), Dolloff F. Bishop (Municipal Environ. Res. Lab., Cincinnati), James E. Bowers (IBM Corp., Gaithersburg, Md.), and Hans W. Treupel (IBM Corp., Gaithersburg, Md.) Nov. 1977 52 p refs
(Contract EPA-68-01-0162)
(PB-274859/8; EPA-600/2-77-211) Avail: NTIS HC A04/MF A01 CSCL 13B

Automatic control strategies using a digital computer on advanced wastewater treatment systems were developed and demonstrated. Two basic pilot treatment systems were automated, physical chemical treatment and the three stage activated sludge system. The digital automation involved control of lime feeding, pH control with CO2, FeC13, sludge wasting, and breakpoint chlorination in the physical-chemical system. In the biological system, the automation involved FeC13 dosage and D.O. control in aeration, pH control in nitrification and CH3OH and alum dosage controls in denitrification. The digital approaches satisfactorily operated the pilot plants. GRA

N78-19000# Mitre Corp., McLean, Va. METREK Div.
A SURVEY ON THE STATE OF RESEARCH IN AUTOMATED SCHEDULING OF URBAN PASSENGER TRANSPORTATION
K. Rebibo and G. Bennington Mar. 1977 49 p refs
(Grant NSF MCS-74-08921-A02)
(PB-274587/5; M72-27) Avail: NTIS HC A03/MF A01 CSCL 13B

A general description of three applications of the use of computers in urban mass transportation scheduling are presented; (1) Urban Transportation Planning System (UTPS), a computerized aid for transportation planners; (2) the Run Cutting and Scheduling (RUCUS) package that assists operation scheduling departments in developing vehicle schedules and driver work assignments form a given set of trip schedules; and (3) realtime control systems for demand responsive transportation. ERA

N78-19001# National Association of Conservation Districts, Washington, D. C.
CONSERVATION DISTRICTS AND 208 WATER QUALITY MANAGEMENT: NON-POINT SOURCE IDENTIFICATION AND ASSESSMENT, SELECTION OF BEST MANAGEMENT PRACTICES, MANAGEMENT AGENCIES, REGULATORY PROGRAMS Final Report
William B. Davey Jun. 1977 353 p Prepared in cooperation with Soil Conservation Service, Washington, D. C. and Bureau of Land Management, Washington, D. C.
(Grant EPA-T-900574-01-0)
(PB-274411/8) Avail: NTIS HC A16/MF A01 CSCL 13B

This publication highlights potential conservation district involvement in the preparation and implementation of state and areawide water quality management plans. It is keyed to the required water quality management planning elements specified in Environmental Protection Agency regulations. The document is directed primarily to water quality planners, conservation districts, and state soil conservation agencies (boards, commissions, committees, councils, or equivalent). Those federal and state agencies with whom conservation districts have cooperative working arrangements as well as various public interest groups may also find the material of interest. GRA

N78-19002# Office of Water Research and Technology, Washington, D.C. Water Resources Scientific Information Center.
SANITARY LANDFILLS: A BIBLIOGRAPHY, VOLUME 2 Technical Report, Jun. 1972 - Feb. 1977
Apr. 1977 235 p
(PB-274440/7; OWRT/WRSIC-77/203-Vol-2; W78-01004) Avail: NTIS HC A11/MF A01 CSCL 13B

A report, containing 259 abstracts, is another in a series of planned bibliographies in water resources produced from the information base comprising SELECTED WATER RESOURCES ABSTRACTS (SWRA). At the time of search for this bibliography, the data base had 104,878 abstracts covering SWRA through February 1977 (Volume 10, Number 4). Author and subject indexes are included. GRA

N78-19003# Texas Technological Univ., Lubbock. Water Resources Center.
DEVELOPMENT OF AN UNCONVENTIONAL APPROACH TO NITRIFICATION-DENITRIFICATION Final Report
Edgar D. Smith, Robert. M. Sweazy, Dan M. Wells, Milton L. Peeples, C. Baskett Russell, and Ralph H. Ramsey, III Sep. 1977 173 p refs
(Contracts DI-14-34-0001-6045; DI-14-34-0001-7091; OWRT Proj. A-035-TEX(1))
(PB-274398/7; WRC-77-3; W78-01002) Avail: NTIS HC A08/MF A01 CSCL 13B

Studies were conducted to evaluate the feasibility of using an unconventional system for nitrifying and denitrifying sewage effluent. The research plan was to stop the nitrification process at the nitrite step, at which point denitrification was promoted. The primary nitrification study showed that a large, stable, reproducible population of nitrite-forming bacteria may be cultured and maintained by a daily input of ammonium sulfate feed solution to a complete-mix treatment regime. Biological nitrification by this system was a reliable process for accumulating relatively high concentrations of nitrite. The draw-and-fill mode of continuous operation in the primary study indicated that this form of nonconventional denitrification was a reliable process for removing nitrites from wastewater. GRA

N78-19004# Transportation Research Board, Washington, D. C.
TRANSIT PLANNING AND OPERATIONS
William F. Hoey 1977 70 p refs Presented at 56th Ann. Meeting of the Transportation Res. Board
(PB-274535/4; TRB/TRR-625) Avail: NTIS HC A04/MF A01 CSCL 13B

Contents: Attitude surveys, transit planning, and automobile-use constraints; Marketing approach using product diffusion knowledge to measure consumer transit attitudes; Consumer reaction to transit marketing in Boulder, Colorado; Analysis of user response to the 1975 New York City transit-fare increase; Cost increases, cost differences, and productivity of transit operations in New York State; Transit costs during peak and off-peak hours; Strategy for implementing integrated regional transit; Bus transit route demand model; Mass transit guidelines versus a consumer orientation in public transportation systems; Bus passenger service-time distributions; Differential time-of-day transit-fare policies: revenue, ridership, and equity; Approach to the planning and design of transit shelters; Role of simulation models in the transit-station design process; Rehabilitation of suburban rail stations. GRA

N78-19005# Washington Univ., Seattle. Urban Transportation System.
POTENTIAL FOR BETTERMENT DISTRICT FINANCING AND JOINT DEVELOPMENT APPLICATIONS TO SURFACE TRANSIT Research Report, Jul. 1976 - Jun. 1977
Robert G. Shawcroft, Edgar M. Horwood, and Martha S. Lester Jul. 1977 65 p refs Sponsored by Urban Mass Transportation Admin.
(PB-274618/8; RR-77-7; UMTA-WA-11-0005-77-1) Avail: NTIS HC A04/MF A01 CSCL 13B

A general methodology for evaluation land use and investment activity with respect to land in the vicinity of surface transit facilities was proposed. The three major objectives were: to determine if there are incremental benefits accruing to land near bus, trolley, and by inference light rail facilities; to examine equity issues in potential tax benefit districts serving such facilities; and to examine the potential of joint development with respect to surface transit. An underlying objective was the presentation of an interactive spatial analysis system suited to the small scale study of transit system impacts and relationship to their environment. Primary focus was directed to exploring locations in the vicinity of multiple routes where levels of commercial and multi-family new investment might be particularly high. The study concludes that the use of special benefit districts would be difficult to operationalize and that joint development opportunities are encouraging. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N78-19006 North Carolina Univ., Chapel Hill.
MODELS FOR X-RAY AND RADIO EMISSION FROM CLUSTERS OF GALAXIES Ph.D. Thesis
Gordon Dean Holman 1977 99 p
Avail: Univ. Microfilms Order No. 77-27260

Inverse Compton models for the extended X-ray sources observed in rich clusters of galaxies are developed and discussed. A discussion of thermal bremsstrahlung models is also included. Solutions were obtained for the diffusion from a stationary point source of relativistic particles which are in verse Compton scattering the universal black body background radiation. The diffusion of particles from a moving source was also considered. The steady state solution obtained when inverse Compton energy losses are balanced by the injection of new particles was applied to the Perseus cluster of galaxies. Relating the clustier X-ray emission to the core-halo radio source 3C84A and assuming that the size of both sources is determined by energy losses, a self-consistent model was obtained. Finally, the cosmological evolution of the luminosity and size of inverse Compton sources was considered. Dissert. Abstr.

N78-19007 Cornell Univ., New York.
A PRACTICAL HADAMARD SPECTROMETER FOR ASTRONOMICAL APPLICATION Ph.D. Thesis
Ming-Hing Tai 1977 223 p
Avail: Univ. Microfilms Order No. 77-28387

A grating spectrometer with its entrance mask and exit mask using Hadamard matrices was developed for 10 microns infrared observations. The mathematical properties of the Hadamard matrix and its applicability to the optical spectrometer were explored. The instruments, including the Hadamard transform spectrometer, the helium cooled dewer, and the real time computer calculation, are described. The results of various performance tests and calibrations are presented. Dissert. Abstr.

N78-19008 Cornell Univ., New York.
THE 16 TO 40 MICRON SPECTRA OF JUPITER AND VENUS Ph.D. Thesis
Robert Alen Reed 1977 146 p
Avail: Univ. Microfilms Order No. 77-28408

Far infrared absorption of sulfuric acid in Venus, and pressure induced far infrared absorption of hydrogen in Jupiter were detected during observations made in the 16 to 40 micron wavelength range using the NASA Learjet observatory. Theorectical interpretation of the data discussed include the thermal structure and H:He abundance ratio in the Jovian atmosphere, the problem of Jovian thermal excess, and the composition of the Venus clouds. Dissert. Abstr.

N78-19009 Texas Univ., Austin.
PHOTOMETRIC STUDY OF THE STRUCTURE OF LENTICULAR GALAXIES Ph.D. Thesis
Vassiliki Tsikoudi 1977 238 p
Avail: Univ. Microfilms Order No. 77-29111

Photographic surface photometry of three edge-on lenticular galaxies, NGC 3115, 4111 and 4762, is presented. Photometric parameters characteristic of each galaxy, such as total integrated magnitudes and colors as well as intrinsic photometric quantities, were obtained from long exposure photographic plates photoelectrically calibrated into luminosity profiles. Analysis of several cross sections perpendicular to the major axis at various distances from the centers, indicated that, the thin disk so prominent in

lenticular nebulae, is not seeing-limited and has Gaussian distribution in the direction perpendicular to the galaxy's equatorial plane, merging into an extensive exponential decay, very probably due to the surrounding envelope. Dissert. Abstr.

N78-19010 Massachusetts Univ., Amherst.
NEUTRON STAR CRUST-NEUTRON SUPERFLUID FRICTIONAL FORCES Ph.D. Thesis
David Scott Harding 1977 105 p
Avail: Univ. Microfilms Order No. 77-30554

A formalism was developed for the calculation of the rate of momentum transfer between two weakly coupled systems moving relative to each other. This formalism was applied to several different scattering mechanisms which occur within the crust of a neutron star. A neutron superfluid penetrates into a portion of the crust of a neutron star. The crust and the neutron superfluid interact only weakly in this region of coexistence and will, in general, rotate at different rates. Because of the relative motion between the crust and the neutron superfluid, a mutual frictional force arises due to the scattering of neutron fluid excitation from phonons and lattice imperfections. The formalism was used to calculate the mutual frictional force, important in determining the rate of frictional heating within the star, and also to calculate the response of a neutron star to a sudden change in both its period and period time derivative.
Dissert. Abstr.

N78-19011 Northwestern Univ., Evanston, Ill.
A SPECTROSCOPIC INVESTIGATION OF THE Be BINARY SYSTEM PHI PERSEI Ph.D. Thesis
Elaine Marie Hendry 1977 500 p
Avail: Univ. Microfilms Order No. 77-32311

The results of an extensive spectroscopic investigation of the phi Persei Be binary system are presented. Evidence is given to support a model of the system which includes a B2 Vne primary star and a B3 Ve secondary star. Both stars possess eccentric rings or discs. The primary evidence presented for this early-type model consists of five major points: (1) the consistent duplicity of the triplet lines of He 1; (2) the appearance of lines of other elements which are consistent with early spectral classes; (3) the composite nature of the underlying wide Balmer absorption lines; 4) the existence of satellite components to the Balmer central absorption cores; and (5) the composite nature of the hydrogen emission lines. Dissert. Abstr.

N78-19012*# National Aeronautics and Space Administration, Washington, D. C.
PULKOVO OBSERVATORY: AN ESSAY ON ITS HISTORY AND SCIENTIFIC ACTIVITY
Aleksandr Nikolaevich Dadaev (NASA. Ames Res. Center) Jan. 1978 239 p refs Transl. into ENGLISH of the book "Phlkovskaya Observatoriya" Leningrad, Nauka Press, 1972 p 1-149
(NASA-TM-75083) Avail: NTIS HC A11/MF A01 CSCL 03A

A history of the observatory and of the development of astronomy in Russia during the past 150 years is presented. Scientific activity was traced from the earliest objectives of precise stellar coordinates to the problems of radio variabilities of quasars. M.V.

N78-19013*# Santa Barbara Research Center, Goleta, Calif.
PHOTOPOLARIMETRY OF SCATTERING SURFACES AND THEIR INTERPRETATION BY COMPUTER MODEL Final Report
Samuel F. Pellicori and Milo Wolff 31 Jan. 1978 173 p refs (Contract NASw-2985)
(NASA-CR-155305) Avail: NTIS HC A08/MF A01 CSCL 03A

A basic understanding of the mechanisms which produce the observable polarimetric and photometric properties of rough surfaces makes it possible to interpret photopolarimetric data in terms of the properties of the surface material of celestial objects. Wolff's mathematical model of a dark, rough, surface was improved so as to more readily enable deduction of surface properties and the Widorn slope albedo rule was analyzed with a view to understanding its theoretical basis and placing it on a firmer ground of knowledge. Algorithms and other aids are provided for astronomers seeking to interpret photopolarimetry.
Author

N78-19014# Air Force Geophysics Lab., Hanscom AFB, Mass.
THE AFGL FOUR COLOR INFRARED SKY SURVEY: SUPPLEMENTAL CATALOG Environmental Research Papers
Stephan D. Price 12 Jul. 1977 84 p refs
(ARPA Order 1366)
(AD-A048048; AFGL-TR-77-0160; AFGL-ERP-606) Avail: NTIS HC A05/MF A01 CSCL 03/1

Positions and magnitude measurements at effective wavelengths of 4.2, 11.0, 19.8, and 27.4 micrometers are reported for an additional 2477 sources observed during the AFGL survey program. These sources were obtained by relaxing the stringent selection criteria used for the main catalog and subjectively selecting those that have associations and/or other characteristics which make them of interest for future investigation. GRA

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N78-19015 Colorado Univ., Boulder.
THE INTERACTION OF A STRONG STELLAR WIND WITH THE INTERSTELLAR MEDIUM Ph.D. Thesis
Robert Paul Weaver 1977 127 p
Avail: Univ. Microfilms Order No. 77-29985

The interaction of a strong stellar wind from a hot, supergiant star with its environment was studied. A shock will form around the star and sweep up interstellar gas as it expands. After a very short time, the circumstellar shell of shocked interstellar gas will collapse due to radiative cooling. During this phase the star appears to be blowing a bubble into the interstellar medium. The detailed hydrodynamic and time dependent ionization structure of the thermal conduction dominated interior of this bubble was calculated as a function of space, assuming spherical symmetry and an approximate similarity solution. The evolution of this interstellar bubble was then approximated by requiring energy and momentum conservation. The adopted alogrithm predicts deviations from the initial similarity solution and thus allows a detailed model to be calculated at any advanced time.
Dissert. Abstr.

N78-19016*# Planetary Science Inst., Tucson, Ariz.
LOW-SPEED IMPACT PHENOMENA AND ORBITAL RESONANCES IN THE MOON- AND PLANET-BUILDING PROCESS Semiannual Report
Clark R. Chapman 30 Dec. 1977 73 p refs
(Contract NASw-2909)
(NASA-CR-155310) Avail: NTIS HC A04/MF A01 CSCL 03B

A simulation of collisional and gravitational interaction in the early solar system generates planets approximately 1000 km in diameter from an initial swarm of kilometer sized planetesimals. The model treats collisions according to experimental and theoretical impact results (such as rebound, cratering, and catastrophic fragmentation) for a variety of materials whose parameters span plausible values for early solid objects. The small planets form in approximately 1000 yr, during which time most of the mass of the system continues to reside in particles near the original size. The simulation is terminated when the largest objects' random motion is of smaller dimension than their collision cross-sections. The few 1000 km planets may act as seeds for the subsequent, gradual, accretional growth into full-sized planets. Author

N78-19017# Royal Inst. of Tech., Stockholm (Sweden). Div. of Plasma Physics.
ON RELATIVISTIC DUST GRAINS AND EXTENSIVE AIR SHOWERS .
K. Aastroem Apr. 1977 26 p refs
(TRITA-EPP-77-17) Avail: NTIS HC A03/MF A01

The hypothesis of dust grain origin of giant extensive air showers was reexamined. It was found that the electron to muon size gives a more decisive test than a study of lateral distribution functions. From the expected muon size and estimated electron size it was concluded that dust grains must be accelerated to

energies greater than 2000 GeV/N. Considering conventional grains with a density rho in the range of 2 to 3 g/ccm it is very unlikely that these could be accelerated within a confinement region of heliospheric dimensions. Author (ESA)

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N78-19018 Florida Univ., Gainesville.
SEARCH FOR CORRELATED RADIO AND OPTICAL EVENTS IN LONG-TERM STUDIES OF EXTRAGALACTIC SOURCES Ph.D. Thesis
Richard Bryan Pomphrey 1977 261 p
Avail: Univ. Microfilms Order No. 77-25948

An attempt is made to assemble the long term records of optical and radio fluxes of a large sample of variable extragalactic sources in a search for correlated radio and optical events, using a linear cross correlation analysis to reinforce visual comparisons. The general background of this research topic is presented. A brief overview of the theoretical considerations involved in research on variable extragalactic objects are presented. The character of the radio, infrared, and optical spectra, their changes with time and possible causes, with emphasis on the synchrotron and inverse Compton mechanisms and the expanding source model are reviewed. A simple method of synthesizing evenly spaced time series is discussed. Documentation of the long term optical and radio variations is presented graphically. The results of the correlation analysis are presented. Dissert. Abstr.

N78-19019 Wisconsin Univ., Madison.
VENUS STRATOSPHERIC CIRCULATION: A DIAGNOSTIC STUDY Ph.D. Thesis
Sanjay Shridhar Limaye 1977 126 p
Avail: Univ. Microfilms Order No. 77-19772

A space-time composite of television pictures from Mariner 10, simulating a view that would have been obtained if the spacecraft had flown over one of the poles of Venus, indicated a circumpolar vortex organization of the ultraviolet features with a bright, elliptic cloud situated over either pole. Motions of features viewed in ultraviolet images were highly zonal in the same direction as the slow rotation of the solid planet. The zonal component of motion at the equator was about -95 1/ms and increased with latitude to a maximum magnitude 10 to 30 1/ms larger than the equatorial value, near 40 degrees latitude in either hemisphere. The zonal component was observed to decrease to -75 degrees 1/ms near 60 degrees latitude. The results verify that Venus' stratospheric circulation in either hemisphere is composed of a hemispheric, circumpolar vortex with an implied mass flow towards the pole. Dissert. Abstr.

N78-19020*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO 14 COARSE FINES (4-10 mm) SAMPLE LOCATION AND CLASSIFICATION
Frank E. Kramer (Northrop Services, Inc., Houston, Tex.) and David B. Twedell (Northrop Services, Inc., Houston, Tex.) Jun. 1977 93 p refs
(NASA-TM-79348; JSC-12992) Avail: NTIS HC A05/MF A01 CSCL 03B

The 4 to 10 mm sieve fraction from the soil samples collected during the Apollo 14 Mission was identified and described. Examination and description of the fines were carried out in nitrogen-filled, stainless steel cabinets during a general examination of the Apollo 14 sample collection. Each particle was held between forceps, dusted in a jet of N2, and placed on a teflon-covered stage. They were examined with a binocular microscope, separated by lithology, and the lithologic types described. Weights of individual particles in the fraction ranged from about 0.10 to 0.50 gm, large enough in size for studies of age, chemistry, and petrology to be accomplished. Author

N78-19021*# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
LUNAR SAMPLE ANALYSIS Annual Report, 1 Feb. 1977 - 31 Jan. 1978
R. M. Housley Jan. 1978 14 p refs
(Contract NAS9-11539)
(NASA-CR-151618; SC507-35AR; AR-6) Avail: NTIS HC A02/MF A01 CSCL 03B

Flameless atomic absorption, X-ray photoemission spectroscopy, ferromagnetic resonance, scanning electron microscopy, and Moessbauer spectroscopy were used to investigate the evolution of the lunar regolith, the transport of volatile trace metals, and the surface composition of lunar samples. The development of a model for lunar volcanic eruptions is also discussed. Author

N78-19022*# Brown Univ., Providence, R. I.
SIGNIFICANT ACHIEVEMENTS IN THE PLANETARY PROGRAM, 1976 - 1977
James W. Head, ed. Mar. 1978 52 p Presented at the Ann. Meeting of the Planetary Geol. Program Principal Invest., St. Louis, Mo., 23-25 May 1977 Sponsored by NASA
(NASA-CR-2956) Avail: NTIS HC A04/MF A01 CSCL 03B

Recent developments in planetology research as reported at the 1977 NASA Planetology Program Principal Investigators meeting are summarized. Important developments are summarized in topics ranging from solar system evolution, comparative planetology, and geologic processes, to techniques and instrument development for future exploration. Author

N78-19034*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE MJS-77 MAGNETOMETER ACTUATOR
William C. Stange *In its* The 11th Aerospace Mech. Symp. Apr. 1977 p 77-86 refs (For availability see N78-19026 09-99)
Avail: NTIS HC A11/MF A01 CSCL 03B

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N78-19023# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 397, SEPTEMBER 1977. PART 1: DATA FOR AUGUST - JULY 1977
Helen E. Coffey Sep. 1977 123 p
(PB-274823/4; SGD-397-Pt-1; NOAA-77101719-Pt-1) Avail: NTIS HC A06/MF A01 CSCL 03B

Data provided on: alert periods, daily solar indices, solar flares, solar radio waves, coronal holes, solar X-ray radiation, spacecraft observations, inferred IP magnetic field polarities, mean solar magnetic field, and solar wind measurements. Author

N78-19024# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 397, SEPTEMBER 1977. PART 2: DATA FOR MARCH - FEBRUARY 1977 AND MISCELLANEA
Helen E. Coffey Sep. 1977 44 p
(PB-274824/2; SGD-397-Pt-2; NOAA-77101720-Pt-2) Avail: NTIS HC A03/MF A01 CSCL 03B

Data provided on: active regions, synoptic solar maps, solar flares, solar radio waves, energetic solar particles and plasma, synoptic chart, abbreviated calendar record, regional flare index, solar radio waves, and geomagnetic indices. Author

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N78-19025*# Aerospace Corp., El Segundo, Calif. Ivan A. Getting Labs.
ENERGETIC ELECTRONS AT THE SYNCHRONOUS ALTITUDE, 1974 - 1977 Interim Report
George A. Paulikas, J. Bernard Blake, and Henry H. Hilton 8 Nov. 1977 47 p refs
(Contracts NASw-2762; NASw-2879; NAS5-23788; F04701-77-C-0078)
(NASA-CR-155775; AD-A048432; TR-0078(3960-05)-1; SAMSO-TR-77-213) Avail: NTIS HC A03/MF A01 CSCL 20/8

A description of the energetic (140 kev to = 3.9 Mev) electron environment observed at the synchronous altitude during the 1974-1977 time interval is presented. These results were obtained by an experimental carried on the geostationary ATS-6 spacecraft. Observations were made at several longitudes. Electron fluxes exhibit a complex temporal behavior ranging in time scale from a diurnal variation to a semi-annual variation. Average fluxes are computed and compared with earlier studies and models. Author (GRA)

99 GENERAL

N78-19026*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE 11TH AEROSPACE MECHANISMS SYMPOSIUM
Apr. 1977 235 p refs Symp. held at Greenbelt, Md., 28-29 Apr. 1977
(NASA-TM-79350) Avail: NTIS HC A11/MF A01 CSCL 22B

Mechanical devices and drives developed for aerospace applications are described. Satellite flywheels, magnetic bearings, a missile umbilical system, a cartridge firing device, and an oiler for satellite bearing lubrication are among the topics discussed. For individual titles, see N78-19027 through N78-19046.

N78-19027*# Planning Research Corp., Washington, D. C.
DESIGN AND DEVELOPMENT OF THE SPACE SHUTTLE TAIL SERVICE MASTS c14
S. R. Dandage, N. A. Herman, S. E. Godfrey, and R. T. Uda *In* NASA. Goddard Res. Center The 11th Aerospace Mech. Symp. Apr. 1977 p 1-12 refs (For availability see N78-19026 09-99)
Avail: NTIS HC A11/MF A01 CSCL 22D

The results of the tail service masts (TSM) concept verification test are presented along with the resulting impact on prototype design. The design criteria are outlined, and the proposed prototype TSM tests are described. Author

N78-19028*# Societe Matra (France).
SCANNING AND FOCUSING MECHANISMS OF METEOSAT RADIOMETER c35
J. Jouan *In* NASA. Goddard Res. Center The 11th Aerospace Mech. Symp. Apr. 1977 p 13-22 (For availability see N78-19026 09-99)
Avail: NTIS HC A11/MF A01 CSCL 14B

The scanning and focusing mechanisms settled onboard the METEOSAT Radiometer are described. A large camera which will take line by line pictures of the earth from a geostationary satellite in the same manner as a TV picture using both the spin of the spacecraft and the tilt of a telescope is included. The scanning mechanism provides the + or - 9 degrees tilt angle of the telescope through 2,500 elementary steps of 1.256 0.0001 radian. As the radiometer image quality is closely dependent on the characteristics of the scanning law, the mechanism is required to fulfill functional performances specifications particularly severe in terms of linearity of the scan curve, accuracy of each step as well as repeatability of the short-term scanning. The focusing mechanism allows + or - 12 millimeters shift of the telescope focus by step increments of 0.140 mm. The focus adjustment is achieved by moving a dihedral reflector according to a pure straight-line motion. The main requirements of each mechanism are summarized and their design and performances are described in detail. Author

N78-19029*# Hughes Aircraft Co., Culver City, Calif.
MAGNETOMETER DEPLOYMENT MECHANISM FOR PIONEER VENUS c19
William L. Townsend *In* NASA. Goddard Res. Center The 11th Aerospace Mech. Symp. Apr. 1977 p 23-33 (For availability see N78-19026 09-99)
(Contract NAS2-8300)
Avail: NTIS HC A11/MF A01 CSCL 14B

A three segment, 15-foot boom mechanism was developed to deploy magnetometers from the Pioneer Venus orbiter spinning shelf. The stowage mechanism is designed to contain the magnetometers during launch and to deploy these instruments by centrifugal force upon pyrotechnic release. Unique graphite-epoxy boom segments are used for a lightweight design with sufficient strength to withstand a 7.5 g orbit insertion force while extended. The detailed design is described along with the test methods developed for qualification in a one-g field. Author

N78-19030*# Martin Marietta Aerospace, Denver, Colo.
FLY-AWAY RESTRAINT PIN MECHANISM FOR THE ARMY'S PATRIOT MISSILE SYSTEM c15
Frederick W. Knight *In* NASA. Goddard Res. Center The 11th Aerospace Mech. Symp. Apr. 1977 p 35-44 (For availability see N78-19026 09-99)
Avail: NTIS HC A11/MF A01 CSCL 16D

The development of the longitudinal restraint mechanism for the PATRIOT missile system is reviewed. Two approaches for the restraint pin design are discussed: an initial ordnance mechanism, and a passive fly-away mechanism. Because of reliability problems and a desire to reduce cost the fly-away restraint mechanism was chosen. Author

N78-19031*# Teldix Luftfahrt-Ausruestungs G.m.b.H., Heidelberg (West Germany).
MAGNETIC BEARING MOMENTUM WHEELS WITH MAGNETIC GIMBALLING CAPABILITY FOR 3-AXIS ACTIVE ATTITUDE CONTROL AND ENERGY STORAGE c35
Rainer S. Sindlinger *In* NASA. Goddard Res. Center The 11th Aerospace Mech. Symp. Apr. 1977 p 45-55 refs (For availability see N78-19026 09-99)
Avail: NTIS HC A11/MF A01 CSCL 14B

A 3-axis active attitude control system with only one rotating part was developed using a momentum wheel with magnetic gimballing capability as a torque actuator for all three body axes. A brief description of magnetic bearing technology is given. It is concluded that based on this technology an integrated energy storage/attitude control system with one air of counterrotating rings could reduce the complexity and weight of conventional systems. Author

N78-19032*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
AN APPLICATION OF INTERACTIVE COMPUTER GRAPHICS TECHNOLOGY TO THE DESIGN OF DISPERSAL MECHANISMS c60
B. J. Richter and B. H. Welch *In* NASA. Goddard Res. Center The 11th Aerospace Mech. Symp. Apr. 1977 p 57-66 (For availability see N78-19026 09-99)
Avail: NTIS HC A11/MF A01 CSCL 09B

Interactive computer graphics technology is combined with a general purpose mechanisms computer code to study the operational behavior of three guided bomb dispersal mechanism designs. These studies illustrate the use of computer graphics techniques to discover operational anomalies, to assess the effectiveness of design improvements, to reduce the time and cost of the modeling effort, and to provide the mechanism designer with a visual understanding of the physical operation of such systems. Author

N78-19033*# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France). Pyrotechnics Dept.
CARTRIDGE FIRING DEVICE DESIGNED FOR ATTACHMENT, RELEASE AND EJECTION OF A SATELLITE c15
Lucien Pierron *In* NASA. Goddard Res. Center The 11th Aerospace Mech. Symp. Apr. 1977 p 67-76 (For availability see N78-19026 09-99)
Avail: NTIS HC A11/MF A01 CSCL 22B

Design considerations of a cartridge firing device are described. Emphasis is placed on performances regarding satellite attachment and accuracies of the path and velocity during separation and ejection. Tests conducted to demonstrate the device efficiency are discussed. Test set-up for velocity measurement, parameters affecting the ejection velocity, and gas pressure of cartridge fired generators are among the factors covered. J.M.S.

N78-19034*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE MJS-77 MAGNETOMETER ACTUATOR c91
William C. Stange *In its* The 11th Aerospace Mech. Symp. Apr. 1977 p 77-86 refs (For availability see N78-19026 09-99)
Avail: NTIS HC A11/MF A01 CSCL 03B

A two-position (0 deg and 180 deg) actuating mechanism (flipper) driven by alternately-heated wax motors (pellets) used to rotate the low field triaxial fluxgate magnetometer experiment on the 1977 Mariner Jupiter-Saturn spacecraft to its 0 deg and 180 deg positions is described. The magnetic field, power requirements, weight and volume of this device are discussed. The problems encountered in design and development of this mechanism are presented. Author

N78-19035*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
POSITIVE COMMANDABLE OILER FOR SATELLITE BEARING LUBRICATION c15
Gordon E. James *In* NASA. Goddard Res. Center The 11th Aerospace Mech. Symp. Apr. 1977 p 87-95 refs (For availability see N78-19026 09-99)
Avail: NTIS HC A11/MF A01 CSCL 22B

On-orbit commandable lubrication of ball bearings accomplished by direct oil application to the moving ball surfaces was studied. Test results for the lubricant applicator portion of the system are presented in conjunction with a design approach for the reservoir and metering components. Author

N78-19036*# Martin Marietta Corp., Denver, Colo.
DOCKING AND RETRIEVAL MECHANISM c18
J. Robert Tewell and Richard A. Spencer *In* NASA. Goddard Res. Center The 11th Aerospace Mech. Symp. Apr. 1977 p 101-110 refs (For availability see N78-19026 09-99)
(Contract NAS8-31290)
Avail: NTIS HC A11/MF A01 CSCL 22B

An engineering prototype docking and retrieval mechanism (DRM) which enables two spacecraft to dock and be structurally joined on-orbit is described. The joining of two spacecraft or payloads on-orbit supports future planned space activities such as payload servicing, deployment and retrieval, and assembly or large space systems. Advantages of the DRM include: it is a nonimpact docking mechanism; does not require impact absorbing mechanisms or attitude stabilization on the target spacecraft; is capable of docking to a spinning spacecraft; and can spin up and deploy a spinning spacecraft or payload. Author

N78-19037*# Hughes Aircraft Co., Culver City, Calif.
TORQUE-WHILE-TURNAROUND SCAN MIRROR ASSEMBLY c74
Charles John Starkus *In* NASA. Goddard Res. Center The 11th Aerospace Mech. Symp. Apr. 1977 p 111-120 refs (For availability see N78-19026 09-99)
Avail: NTIS HC A11/MF A01 CSCL 20F

A scan mirror assembly which is part of a thematic mapper system is described with emphasis on mechanical aspects of the design. Features of the oscillating scan mirror mechanism include: a low level of structural vibration for the impact energies involved in mirror oscillation and return of energy lost during impact to the mirror by applying torque during the instant of impact. Author

N78-19038*# Laboratoire Suisse de Recherches Horlogeres, Neuchatel (Switzerland).
WEAR-RESISTANT BALL BEARINGS FOR SPACE APPLICATIONS c37
H. Boving, H. E. Hintermann, W. Hanni, E. Bondivenne (ESA), M. Boeto (CNES, Toulouse), and E. Conde (CNES, Toulouse) *In* NASA. Goddard Res. Center The 11th Aerospace Mech. Symp. Apr. 1977 p 121-131 refs (For availability see N78-19026 09-99)
Avail: NTIS HC A11/MF A01 CSCL 13I

Ball bearings consisting of steel parts of which the rings are coated with hard, wear resistant, chemical vapor deposited TiC are described. Experiments conducted in ultrahigh vacuum, using cages of various materials with self-lubricating properties, show that such bearings are suitable for space applications. The results of laboratory tests on the ESA Meteosat Radiometer Focalizing mechanism, which contains six coated bearings, are summarized. Author

N78-19039*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN ACTIVE NUTATION DAMPER FOR SPACECRAFT c18
Richard A. Abercrombie and Thomas W. Flatley *In its* The 11th Aerospace Mech. Symp. Apr. 1977 p 133-145 (For availability see N78-19026 09-99)
Avail: NTIS HC A11/MF A01 CSCL 22A

An active nutation damping device, consisting of an angular accelerometer, a dc-motor-driven flywheel, and associated electronics, developed for spacecraft use is described. This damping system was used on the LAGEOS spacecraft to control nutation buildup during the long coast period (approximately 75 minutes) after the third stage separation. The damper package was evaluated and proven on a three-axis gas-bearing simulator that duplicated the LAGEOS spacecraft critical flight dynamics. In addition, a failure analysis of the damper assembly was performed. Performance of the damper during the LAGEOS flight has confirmed the preflight evaluation and analysis. Author

N78-19040*# Dornier-System G.m.b.H., Friedrichshafen (West Germany).
THE GEOS-20 m CABLE BOOM MECHANISM c15
Guenther K. Schmidt and Klaus Suttner *In* NASA. Goddard Res. Center The 11th Aerospace Mech. Symp. Apr. 1977 p 147-156 refs (For availability see N78-19026 09-99)
Avail: NTIS HC A11/MF A01 CSCL 22B

The GEOS Cable Boom Mechanism which allows the controlled deployment of a 20 m long cable in a centrifugal force field is described. In launch configuration the flat cable is reeled on a 240 mm diameter drum. The electrical connection between the rotating drum and the stationary housing is accomplished via a flexlead positioned inside the drum. Active motion control of this drum is achieved by a self locking worm gear, driven by a stepper motor. The deployment length of the cable is monitored by an optical length indicator, sensing black bars engraved on the cable surface. Author

N78-19041*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A LOW COST HIGH TEMPERATURE SUN TRACKING SOLAR ENERGY COLLECTOR c44
Gerald S. Perkins *In* NASA. Goddard Res. Center The 11th Aerospace Mech. Symp. Apr. 1977 p 157-169 (For availability see N78-19026 09-99)
(Contract NAS7-100)
Avail: NTIS HC A11/MF A01 CSCL 10A

The design and economic evaluation of a low cost high temperature two axis sun tracking solar energy collector are described. The collector design is specifically intended for solar energy use with the freedom of motion about its two control axes being limited only to the amplitude required to track the sun. An examination of the performance criteria required in order to track the sun and perform the desired solar energy conversion is used as the starting point and guide to the design. This factor, along with its general configuration and structural aspect ratios, is the significant contributor to achieving low cost. The unique mechanical design allows the control system to counter wide tolerances that will be specified for the fabrication of the azimuth frame and perform within a small tracking error. Author

N78-19042*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

TWO-DIMENSIONAL OSCILLATING AIRFOIL TEST APPARATUS **c09**

Frank L. Gibson, Andrew J. Hocker, Jr., and Dennis S. Matsuhiro *In* NASA. Goddard Res. Center The 11th Aerospace Mech. Symp. Apr. 1977 p 171-178 (For availability see N78-19026 09-99)

Avail: NTIS HC A11/MF A01 CSCL 14B

A two-dimensional oscillating airfoil test apparatus is presented as a method of measuring unsteady aerodynamic forces on an airfoil or rotor blade section. The oscillating airfoil test rig, which was built for use in NASA Ames Research Center's 11x11-foot Transonic Wind Tunnel (speed range M = 0.4 - 1.4), allows determination of unsteady loadings and detailed pressure distributions on representative airfoil sections undergoing simulated pitching and flapping motions. The design details of the motion generating system and supporting structure are presented. Author

N78-19043*# Societe Nationale Industrielle Aerospatiale, Paris (France).

DEVELOPMENT OF A SATELLITE FLYWHEEL FAMILY OPERATING ON ONE ACTIVE AXIS MAGNETIC BEARINGS **c15**

Pierre C. Poubeau *In* NASA. Goddard Res. Center The 11th Aerospace Mech. Symp. Apr. 1977 p 179-195 ref Sponsored in part by INTELSAT, ESA, and CNES (For availability see N78-19026 09-99)

Avail: NTIS HC A11/MF A01 CSCL 22B

Magnetic bearings with radial passive centering and axial active control of the rotor position are described in terms of optimization for satellite flywheel applications and kinetic storage of energy for satellites. J.M.S.

N78-19044*# Martin Marietta Corp., Orlando, Fla.

THE CONCEPTION, BIRTH, AND GROWTH OF A MISSILE UMBILICAL SYSTEM **c14**

Glenn W. Nordman *In* NASA. Goddard Res. Center The 11th Aerospace Mech. Symp. Apr. 1977 p 197-206 ref (For availability see N78-19026 09-99)

Avail: NTIS HC A11/MF A01 CSCL 22D

The design development of the Sprint 2 and the Improved Sprint 2 Missile System umbilical system is reviewed. Unique system requirements, umbilical designs considered to meet the requirements, and the problems encountered and solutions derived during the design and development testing of the selected systems are described. Author

N78-19045*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

FOCUS DRIVE MECHANISM FOR THE IUE SCIENTIFIC INSTRUMENT **c37**

Edward J. Devine and Thomas B. Dennis, Jr. *In its* The 11th Aerospace Mech. Symp. Apr. 1977 p 207-215 (For availability see N78-19026 09-99)

Avail: NTIS HC A11/MF A01 CSCL 13I

A compact, lightweight mechanism was developed for in-orbit adjustment of the position of the secondary mirror (focusing) of the International Ultraviolet Explorer telescope. This device is a linear drive with small and highly repeatable step increments. Extremely close tolerances are also held in tilt and decentering. The unique mechanization is described with attention to the design details that contribute to positional accuracy. Lubrication, materials, thermal considerations, sealing, detenting against launch loads, and other features peculiar to flight hardware are discussed. The methods employed for mounting the low expansion quartz mirror with minimum distortion are also given. Results of qualification and acceptance testing, are included. Author

N78-19046*# Hawker Siddeley Dynamics Ltd., Stevenage (England). Space Div.

DESIGN AND DEVELOPMENT OF A SOLAR ARRAY DRIVE **c37**

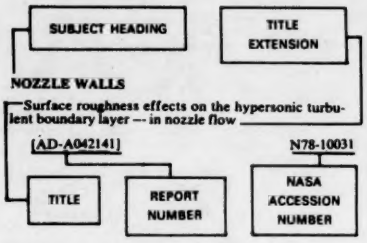
Terence Rees and John M. Standing *In* NASA. Goddard Res. Center The 11th Aerospace Mech. Symp. Apr. 1977 p 217-235 (For availability see N78-19026 09-99)

Avail: NTIS HC A11/MF A01 CSCL 13I

The design and development of a dry lubricated direct drive solar array pointing mechanism is discussed for use on the Orbital Test Satellite (OTS), MAROTS, European Communication Satellite (ECS), and others. Results of life testing the original prototype and the OTS mechanism are presented together with an appraisal of expected future development. Author

SUBJECT INDEX

Typical Subject Index Listing



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A

ABILITIES
Effects of two calculus treatments upon achievement and critical thinking ability
N78-18833
ABLATIVE MATERIALS
Analytic solution for the equilibrium composition of a carbon-nitrogen-oxygen gas mixture
[AD-A048597] N78-18161
ABSORBERS [MATERIALS]
Partial differential rate equations for a bilevel absorber
[AD-A048601] N78-18854
ABSORPTION SPECTRA
Determination of optical constants of phosphates, sulphates and ammonia and related compounds in the near infrared region
[AD-A048173] N78-18908
Two-photon absorption of molecular crystals and gas — napthalene, biphenyl, and benzene
N78-18950
ABSORPTION SPECTROSCOPY
Studies of carbon monoxide and oxygen chemisorbed on palladium and related metals
N78-18173
ABSORPTIVITY
Gas surface interactions — recombination reactions with tungsten and platinum
[AD-A048667] N78-18160
ABUNDANCE
Survey of ceramic refractory problems and materials shortages
[AD-A048108] N78-18216
ACCELERATED LIFE TESTS
Accelerated laboratory corrosion test for materials and finishes used in naval aircraft
[AD-A048059] N78-18188
ACCELERATION [PHYSICS]
Sudden loss of consciousness in pilots with low intraocular pressure during exposure to G forces
N78-18737
ACCELERATION STRESSES [PHYSIOLOGY]
Studies of circulation during LBNP test aboard Salyut-4 orbital stations
N78-18719
ACCELEROMETERS
Performance characteristics of an attitude velocity acceleration and rate unit [NIS-210-24]
[AD-A048204] N78-18029
Cantilever accelerometer
[AD-A048045] N78-18398
ACCEPTABILITY
FORTRAN compiler validation
[AD-A048317] N78-18780
ACCIDENTS
Safety methodology for space nuclear systems
[AD-A048780] N78-18898
ACETIC ACID
The pVT properties of acetic acid
[NPL-CHEM-76] N78-18166
ACHIEVEMENT
Effects of two calculus treatments upon achievement and critical thinking ability
N78-18833
ACID BASE EQUILIBRIUM
Parameters of acid-base equilibrium and enzymatic activity of blood in man during brief antiorthostatic hypokinesia
N78-18687
ACOUSTIC IMPEDANCE
Investigation of ground reflection and impedance from flyover noise measurements
[NASA-CR-145302] N78-18874
ACOUSTIC PROPERTIES
Effect of design changes on aerodynamic and acoustic performance of translating-centerbody sonic inlets
[NASA-TP-1132] N78-17998
ACOUSTIC SCATTERING
Frequency spreading in forward surface scattering
[AD-A048741] N78-18877
ACOUSTICS
Preliminary experiment on acoustoelasticity for stress analysis
N78-18244
Theory and methods for modelling acoustically long, unpartitioned cavity resonators for engine exhaust systems
N78-18427
ACQUISITION
Developing an acquisitions system for a university library
[BLL-BLRDR-5351] N78-18983
ACRYLIC ACID
Polarized infrared spectral studies of crystalline, hydrogen-bonded organic acids
[AD-A048587] N78-18162
ACRYLIC RESINS
Amalgam stabilization by selective interfacial amalgamation — polyacrylate dental cavity linings
N78-18178
Oxidative stabilization of acrylic fibers. 3: Stabilization dynamics
[AD-A048746] N78-18218
ACTIVITY
Methods for the calculation of the value of the logarithm of the activity coefficient of a component at infinite dilution from binary vapour-liquid data
[NPL-CHEM-74] N78-18165
ACTUATORS
The MJS-77 magnetometer actuator
N78-19034
ADHESIVE BONDING
Characterization of chromic-acid anodized 2024-T3 aluminum adherends
[AD-A048756] N78-18199
Thermal barrier coating system
[NASA-CASE-LEW-12554-1] N78-18355
Progress in structural bonding through effective bondline stress analysis
[DLR-IB-152-77/18] N78-18468
ADSORPTION
Charcoal regeneration. Part 1: Mechanism of TNT adsorption
[AD-A048757] N78-18578
ADVECTION
A snow index using 200mb warm advection
[PB-275184/0] N78-18657
AERIAL PHOTOGRAPHY
An example of appyling remote sensing to a Corps of Engineers archeological problem
[AD-A048106] N78-18503
AERODYNAMIC CHARACTERISTICS
Theoretical evaluation of high speed aerodynamics for arrow wing configurations
[NASA-TM-78659] N78-17992
A theoretical investigation of the aerodynamics of low-aspect-ratio wings with partial leading-edge separation
[NASA-CR-145304] N78-17993
Investigation of aerodynamic characteristics of V-wings near solid surface
[AD-A048555] N78-18003
Cambered jet-flapped airfoil theory with tables and computer programs for application
[AD-A048528] N78-18006
Limitations of the CH-47 helicopter in performing terrain flying with external loads
[AD-A048580] N78-18054
AERODYNAMIC CONFIGURATIONS
Effect of design changes on aerodynamic and acoustic performance of translating-centerbody sonic inlets
[NASA-TP-1132] N78-17998
Analytical study of a free-wing/free-trimmer concept — for gust alleviation and high lift
[NASA-CR-2946] N78-18000
AERODYNAMIC DRAG
Drag, flow transition, and laminar separation on nine bodies of revolution having different forebody shapes
[AD-A048274] N78-18001
Parametric transonic evaluation of type A VSTOL nacelle drag
[AD-A048110] N78-18002
AERODYNAMIC HEATING
Transient temperatures in laminated composite conical shells due to aerodynamic heating
N78-18360
AERODYNAMIC LOADS
Calculation of the horizontal tail loads from elevator actuation
[DLR-IB-536-76/4] N78-18011
AERODYNAMIC NOISE
Acoustic interference effects and the role of Helmholtz number in aerodynamic noise
[DLR-IB-257-77/11] N78-18878
AERODYNAMIC STABILITY
Circulation control airfoil study — wind tunnel stability tests
[AD-A048677] N78-18005
Aeromechanical stability of helicopters with a bearingless main rotor. Part 1: Equations of motion
[NASA-TM-78459] N78-18043
Flight-determined stability and control coefficients of the F-111A airplane
[NASA-TM-72851] N78-18075
Separation problems encountered by aircraft designers css Div. des Etudes Avancees.
N78-18377
Aerodynamic stabilization of gaseous discharges
[AD-A048533] N78-18415
AERODYNAMICS
Aeronautical Engineering: A special bibliography with indexes, supplement 91, January 1978
[NASA-SP-7037(91)] N78-17989
AEROELASTICITY
Aeromechanical stability of helicopters with a bearingless main rotor. Part 1: Equations of motion
[NASA-TM-78459] N78-18043
AERONAUTICAL ENGINEERING
Aeronautical Engineering: A special bibliography with indexes, supplement 91, January 1978
[NASA-SP-7037(91)] N78-17989
Separation problems encountered by aircraft designers css Div. des Etudes Avancees.
N78-18377
AEROSOLS
Trace elemental characteristics of aerosols emitted from municipal incinerators
[NASA-TM-78630] N78-18572
A comparative study of the coastal marine aerosol
[AD-A048673] N78-18576
A physically based climate model of hemispheric mean surface temperature with predictive capability
N78-18620
AEROSPACE ENGINEERING
Planning for Materials Processing in Space
[NASA-CR-155786] N78-18090
The 11th Aerospace Mechanisms Symposium
[NASA-TM-79350] N78-19026
AEROSPACE ENVIRONMENTS
Space Biology and Aerospace Medicine, no. 3, 1977
[JPRS-69380] N78-18715
Energetic electrons at the synchronous altitude, 1974 - 1977
[NASA-CR-155775] N78-19025

AEROSPACE MEDICINE

Aerospace Medicine and Biology: A continuing bibliography with indexes, supplement 175
[NASA-SP-7011(175)] N78-18677

Space Biology and Aerospace Medicine, no. 5, 1977
[JPRS-70135] N78-18679

Main stages and prospects of development of space biology and medicine
N78-18680

Aviation medicine on the sixtieth anniversary of the great October revolution
N78-18681

Biomechanical criteria of artificial gravity
N78-18682

Change in gravitation level as a stress factor
N78-18683

Main results of medical research conducted during the flight of two crews on the Salyut-5 orbital station
N78-18684

Distinctions of fluid and electrolyte metabolism and renal function in crew members of the first Salyut-4 expedition
N78-18685

Technique for selective catheterization of the heart and great vessels used in biomedical studies of healthy individuals
N78-18686

Parameters of acid-base equilibrium and enzymatic activity of blood in man during brief antiorthostatic hypokinesia
N78-18687

Main objectives and results of the radiobiological experiment conducted on the Kosmos-690 biosatellite
N78-18688

Lactate dehydrogenase isozymes of rat skeletal muscles following a space flight and with hypokinesia
N78-18689

Morphological manifestations of functional changes in the hypothalamo-hypophyseal neurosecretory system and rat kidneys under the influence of space flight factors
N78-18690

Effect of head orientation in the gravity field on severity of caloric nystagmus
N78-18691

A study of the pulsed method of laundering
N78-18692

Significance of the percussion symptom in detection of peptic ulcers in flight personnel
N78-18693

Space Biology and Aerospace Medicine, no. 3, 1977
[JPRS-69380] N78-18715

Psychopharmacology in aviation and astronautics
N78-18716

Space Biology and Aerospace Medicine, no. 4, 1977
[JPRS-69964] N78-18738

Medical support of the immediate postflight period following long space missions
N78-18741

Clinical and biochemical aspects of human adaptation to central Antarctica as applied to problems of space biology and medicine
N78-18746

AEROSPACE TECHNOLOGY TRANSFER

Rocket gas generators - terrestrial use of space technology
[DLR-IB-456-76/9] N78-18121

AGING [METALLURGY]

The relationship between the microstructure and age hardening response in the metastable beta titanium alloy Ti-11.5Mo6Zr4.5Sn [beta 3]
[AD-A048773] N78-18196

AGRICULTURE

Selection of a seventh spectral band for the LANDSAT-D thematic mapper
[E78-10078] N78-18487

Investigations using data from LANDSAT 2 — Bangladesh
[E78-10080] N78-18489

AIR

Study of an air lift pump in a centrifugal force field
[DLR-FB-77-40] N78-18436

On relativistic dust grains and extensive air showers
[TRITA-EPP-77-17] N78-19017

AIR BREATHING ENGINES

Hybrid propulsive systems: Technology and application
[DLR-IB-456-76/11] N78-18126

AIR CONDITIONING

Site dependent factors affecting the economic feasibility of solar powered absorption cooling
[NASA-CR-150533] N78-18524

AIR CURRENTS

Multivariate analysis of atmospheric particulate composition and computer-controlled interference correction for ion-selective electrode measurements in a flowing stream
N78-18569

AIR FILTERS

EPA fabric filtration studies. 5: Bag cleaning technology, high temperature tests
[PB-274922/4] N78-18596

AIR LAUNCHING

Test and evaluation for an air-launched guided missile program
[AD-A048675] N78-18100

AIR POLLUTION

Clean coal combustion through coal washing and blending
[PB-274406/8] N78-18560

Pilot plant study of conversion of coal to low sulfur fuel
[PB-274113/0] N78-18565

The hazard ranking and allocation methodology: Assembly of the hazard ranking and allocation methodology: Assembly of the hazard estimation data base for air and surface water pollutants
[AD-A047826] N78-18575

A comparative study of the coastal marine aerosol
[AD-A048673] N78-18576

Effect of preconditioning on in-use vehicle testing and failure analysis of evaporative emission control systems
[PB-274902/6] N78-18580

Compliance status of major air pollution facilities
[PB-275005/7] N78-18581

Guidelines for the regional evaluation of state and local NSR [New Source Review] programs
[PB-275053/7] N78-18582

Proceedings of the 2nd stationary source combustion symposium. Volume 4. Fundamental combustion research
[PB-274029/8] N78-18584

Biological significance of some metals as air pollutants. Part 1, lead
[PB-274055/3] N78-18585

Measurement of rate constants of importance in smog
[PB-274530/5] N78-18586

Ozone over San Francisco. Means and patterns during pollution episodes
[PB-274452/2] N78-18588

Gas-atomized spray scrubber evaluation
[PB-274449/8] N78-18589

Proceedings of the 2d Stationary Source Combustion Symposium. Volume 5: Addendum
[PB-274897/8] N78-18590

Review and evaluation of analytical methods for environmental studies of fibrous particulate exposures
[PB-274750/9] N78-18591

Diffuse source pollution: Policy considerations for the states
[PB-274493/6] N78-18592

Improvements to single-source model. Volume 3. Further analysis of modeling results
[PB-274527/1] N78-18593

Shift schedules for emissions and fuel economy testing
[PB-274865/5] N78-18594

Vehicle exhaust emission instruments evaluation
[PB-274547/9] N78-18597

Control strategy preparation manual for particulate matter
[PB-274861/4] N78-18598

Near-surface air parcel trajectories: St. Louis, 1975
[PB-274368/0] N78-18599

The relation of oxidant levels to precursor emissions and meteorological features. Volume 1: Analysis and findings
[PB-275001/6] N78-18618

Carbon monoxide
[PB-274965/3] N78-18713

AIR QUALITY

The 1976 NRL air quality data
[AD-A048750] N78-18579

Aircraft emission factors
[PB-275067/7] N78-18595

AIR TRAFFIC

Uplink coverage measurements in the Los Angeles area for passive BCAS — collision avoidance
[AD-A048288] N78-18027

AIR TRAFFIC CONTROL

Characterization of current tower cab environments
[AD-A048306] N78-18026

The impact of a proposed active BCAS on ATCBBS performance in the Washington, D. C., 1981 environment
[AD-A048589] N78-18032

Concepts for estimating capacity of basic runway configurations
[PB-274578/4] N78-18036

Benefits of MLS guidance for curved approaches. Volume 2: Operational benefits for New York Airports
[PB-274585/9] N78-18037

Concepts for determination of longitudinal separation standards on final approach
[PB-274590/9] N78-18038

AIR TRANSPORTATION

Air transportation energy efficiency
N78-18540

Federal policy options to effect fuel conservation in the air industry
N78-18548

Measuring the impact on scheduled air lines operations of restrictions in fuel availability
N78-18549

AIRBORNE EQUIPMENT

The use of pyranometers in aircraft
[ESA-TT-433] N78-18408

A system analysis of the 13.3 GHz — antenna patterns and signal transmission
[NASA-CR-151627] N78-18496

AIRCRAFT ACCIDENT INVESTIGATION

The analysis of National Transportation Safety Board large fixed-wing aircraft accident/incident reports for the potential presence of low-level wind shear
[AD-A048354] N78-18021

An analysis of three weather-related aircraft accidents
[NASA-CR-155363] N78-18024

AIRCRAFT ACCIDENTS

The analysis of National Transportation Safety Board large fixed-wing aircraft accident/incident reports for the potential presence of low-level wind shear
[AD-A048354] N78-18021

An analysis of three weather-related aircraft accidents
[NASA-CR-155363] N78-18024

AIRCRAFT ANTENNAS

Aircraft response effect on E-field measurements
[AD-A047986] N78-18272

The geometrical theory of diffraction - a method for the solution of electromagnetic boundary value problems of complicated structures in the high frequency case — satellite and aircraft antennas
N78-18290

The integral equation method - a computational method for diffracted and scattered fields of complicated structures — satellite and aircraft antennas
N78-18291

AIRCRAFT COMMUNICATION

Objective measurement of voice channel intelligibility
[AD-A048611] N78-18264

AIRCRAFT COMPARTMENTS

Studies of the flash fire potential of aircraft cabin interior materials
[AD-A048475] N78-18158

AIRCRAFT CONFIGURATIONS

The analysis of National Transportation Safety Board large fixed-wing aircraft accident/incident reports for the potential presence of low-level wind shear
[AD-A048354] N78-18021

AIRCRAFT CONTROL

Analytical study of ride smoothing benefits of control system configurations optimized for pilot handling qualities
[NASA-TP-1148] N78-18076

Fault-tolerant software for aircraft control systems
[NASA-CR-145298] N78-18797

AIRCRAFT DESIGN

Analytical study of a free-wing/free-trimmer concept — for gust alleviation and high lift
[NASA-CR-2946] N78-18000

Separation problems encountered by aircraft designers css Div. des Etudes Avancees.
N78-18377

AIRCRAFT ENGINES

F-15/nonaxisymmetric nozzle system integration study support program
[NASA-CR-135252] N78-18070

Aircraft emission factors
[PB-275067/7] N78-18595

AIRCRAFT EQUIPMENT

Exploratory development of conductive coating materials — for use on aircraft radomes
[AD-A048253] N78-18138

AIRCRAFT LANDING

Effect of winglets on a first-generation jet transport wing. 4: Stability characteristics for a full-span model at Mach 0.30
[NASA-TP-1119] N78-17997

Concepts for estimating capacity of basic runway configurations
[PB-274578/4] N78-18036

Benefits of MLS guidance for curved approaches. Volume 2: Operational benefits for New York Airports
[PB-274585/9] N78-18037

Concepts for determination of longitudinal separation standards on final approach
[PB-274590/9] N78-18038

The application of techniques for predicting STOL aircraft response to wind shear and turbulence during the landing approach
[UTIAS-215] N78-18077

Flight test of stick force stability in attitude-stabilized aircraft
[NLR-MP-77015-U] N78-18080

Full color hybrid display for aircraft simulators — landing aids
[NASA-CASE-ARC-10903-1] N78-18083

AIRCRAFT MAINTENANCE

Research requirements to reduce maintenance costs of civil helicopters
[NASA-CR-145288] N78-17990

AIRCRAFT MODELS

Flight tests of a radio-controlled airplane mode with a free-wing, free-canard configuration
[NASA-TM-72853] N78-18042

AIRCRAFT NOISE
GE core engine noise investigation, low emission engines
[AD-A048590] N78-18069
Investigation of ground reflection and impedance from flyover noise measurements
[NASA-CR-145302] N78-18874
AIRCRAFT PERFORMANCE
Optimal level controls of high performance aircraft
[DLR-IB-552-77/20] N78-18059
AIRCRAFT RELIABILITY
Airworthiness evaluation NUH-1H helicopter with global positioning system
[AD-A047971] N78-18053
AIRCRAFT STABILITY
Effect of winglets on a first-generation jet transport wing. 4: Stability characteristics for a full-span model at Mach 0.30
[NASA-TP-1119] N78-17997
AIRCRAFT STRUCTURES
Calculation methods for fatigue life and crack propagation
N78-18049
Tests on details and components
N78-18050
Current standards of fatigue test on strike aircraft
[AGARD-AR-92] N78-18051
Fatigue load monitoring
N78-18052
Third Conference on Fibrous Composites in Flight Vehicle Design, part 1
[NASA-TM-X-3377-PT-1] N78-18133
Third Conference on Fibrous Composites in Flight Vehicle Design, part 2
[NASA-TM-X-3377-PT-2] N78-18134
AIRFOIL PROFILES
Collection of supercritical aerofoils obtained with the NLR hodograph method
[NLR-TR-75115-U] N78-18009
AIRFOILS
Circulation control airfoil study — wind tunnel stability tests
[AD-A048677] N78-18005
Cambered jet-flapped airfoil theory with tables and computer programs for application
[AD-A048528] N78-18006
Prediction of unsteady separated flows on oscillating airfoils
N78-18387
Two-dimensional oscillating airfoil test apparatus
N78-19042
AIRFRAME MATERIALS
Third Conference on Fibrous Composites in Flight Vehicle Design, part 1
[NASA-TM-X-3377-PT-1] N78-18133
Third Conference on Fibrous Composites in Flight Vehicle Design, part 2
[NASA-TM-X-3377-PT-2] N78-18134
AIRFRAMES
Flight qualification of titanium F-14A airframe components manufactured by Hot Isostatic Pressing [HIP]
[AD-A048485] N78-18055
AIRLINE OPERATIONS
A simulation model for an enplaning-passenger-vehicle curbside at high-volume airports
N78-18020
The influence of the journey's time of day on the de- and resynchronization of the 24-hour rhythm of body and temperature after transatlantic flights
[ESA-TT-420] N78-18708
AIRPORT TOWERS
Characterization of current tower cab environments
[AD-A048306] N78-18026
AIRPORTS
A simulation model for an enplaning-passenger-vehicle curbside at high-volume airports
N78-18020
Benefits of MLS guidance for curved approaches. Volume 2: Operational benefits for New York Airports
[PB-274585/9] N78-18037
Concorde noise-induced building vibrations John F. Kennedy International Airport
[NASA-TM-78660] N78-18873
AIRSHIPS
Supporting investigations during testing of the WDL-1 airship in Ghana and Upper Volta — hull temperature, flight data, operational problems
[DLR-IB-536-77/1] N78-18012
AIRSPEED
A flight evaluation of a trailing anemometer for low-speed calibrations of airspeed systems on research aircraft
[NASA-TP-1135] N78-18044
ALASKA
Application of remote sensing data to surveys of the Alaskan environment
[E78-10077] N78-18486
Environmental assessment of the Alaskan continental shelf. Northeast gulf of Alaska
[PB-275212/9] N78-18619
ALGEBRA
Approximation by algebraic numbers of bounded degree
N78-18835
Some problems concerning residual finiteness in algebras
N78-18837
Correspondences and admissible polynomials
N78-18839
Direct solutions of large, sparse linear systems
[AD-A047776] N78-18843
Interplay between algebra and topology: Groupoids in a variety
N78-18866
ALGOL
The diagnostic facilities in ALGOL and FORTRAN compilers
[NPL-NAC-81] N78-18786
ALGORITHMS
Statistical estimation theory applied to synchronous generator modeling
N78-18306
An algorithm for testing the planarity of partially oriented graphs
[AD-A048052] N78-18314
Cluster compression algorithm: A joint clustering/data compression concept
[NASA-CR-155780] N78-18495
Sleep wakefulness determinations from heart rate data, volume 3
[AD-A045817] N78-18703
Simulation of packet communication architecture
[AD-A048290] N78-18783
An investigation of the bearing accuracy of two passive multi-channel array algorithms in the presence of correlated noise
N78-18791
The analysis and synthesis of some advanced techniques for digital simulation
N78-18792
Network versus linear programming algorithms and implementations
[AD-A048296] N78-18804
On the use of matrix factorization techniques in penalty function methods for structured linear programs
[IIASA-RM-77-21] N78-18810
Compensator improvement for multivariable control systems
N78-18820
Algorithmic undecidability
N78-18838
An algorithmic approach for reducing kinematically similar differential systems
[AD-A047781] N78-18845
Network reliability analysis: Algorithms and complexity
N78-18863
ALIGNMENT
IUS prerelease alinement
[NASA-TM-79349] N78-18104
ALKALI METALS
Laser absorption phenomena in flowing gas devices
[NASA-CR-135129] N78-18411
ALKALOIDS
Structure elucidation by nuclear magnetic resonance spectroscopy — bisbenzylisoquinoline alkaloids
N78-18145
ALL-WEATHER AIR NAVIGATION
The philosophy adopted for the flight testing of the Panavia Tornado avionics system in Hack aircraft
N78-18060
ALLOYS
Initial and final state effects in Auger and X-ray photoelectron spectroscopies
N78-18144
The role of trapping on hydrogen transport and embrittlement
N78-18175
ALTITUDE TESTS
Relationship between onset of altitude-decompression disorders in man and barometric pressure level during intensive physical exercise
N78-18758
ALUMINUM
Tensile stress-strain behavior of boron/aluminum laminates
[NASA-TP-1117] N78-18135
High strength aluminum casting technology: Squeeze casting of 7075 alloy
[AD-A048657] N78-18192
ALUMINUM ALLOYS
Investigation into the effect of dissimilar metal coupling, potential, and processing on the mode and distribution of galvanic corrosion attack on 5086 aluminum alloy in synthetic seawater
[AD-A048527] N78-18190
Characterization of chromic-acid anodized 2024-T3 aluminum adherends
[AD-A048756] N78-18199
Influence of microstructure on fatigue crack propagation rate of aluminium alloys
[ESA-TT-418] N78-18203
ALUMINUM OXIDES
The chemical, mechanical, and implant properties of glass-coated alumina
N78-18130
AMBIGUITY
Ambiguous range study report
[AD-A048612] N78-18033
Totally and partially ambiguous points of planar functions
N78-18834
AMIDES
The photochemistry of amides and phthalimides
N78-18149
AMMONIA
Effect of gamma radiation on intensity of ammonia excretion in albino rats
N78-18735
Determination of optical constants of phosphates, sulphates and ammonia and related compounds in the near infrared region
[AD-A048173] N78-18908
AMMONIUM COMPOUNDS
Chemically polished quartz — using ammonium bifluoride
[AD-A048077] N78-18958
AMPLIFICATION
Independent gain and bandwidth control of a traveling wave maser
[NASA-CASE-NPO-13801-1] N78-18410
AMPLIFIER DESIGN
Amplification and discrimination of signals from proportional multiwire chambers
[ISS-T-76/6] N78-18344
AMPLIFIERS
Building block modules: Frequency synthesizer and amplifier-mixer
[AD-A048209] N78-18320
ANALOG COMPUTERS
Use of the MA-48L iterative analog computer in control system designing
[AD-A048559] N78-18827
ANALOG SIMULATION
Some applications of discrete analog signal processing to pattern recognition
N78-18818
ANALYSIS [MATHEMATICS]
A new computational method for constrained nonlinear programming
N78-18793
On the distribution of the greatest common divisor
[AD-A048791] N78-18853
ANALYTICAL CHEMISTRY
Simultaneous kinetic and spectral analysis using a vidicon rapid-scanning stopped-flow spectrometer
N78-18155
Review and evaluation of analytical methods for environmental studies of fibrous particulate exposures
[PB-274750/9] N78-18591
ANALYZERS
A study for hypergolic vapor sensor development
[NASA-CR-155770] N78-18224
ANEMOMETERS
A flight evaluation of a trailing anemometer for low-speed calibrations of airspeed systems on research aircraft
[NASA-TP-1135] N78-18044
An investigation of metal versus ligand centered redox processes in selected transition metal macrocyclic complexes. The application of a microcomputer to voltammetry
N78-18153
ANESTHESIOLOGY
Medical support of the immediate postflight period following long space missions
N78-18741
ANGLE OF ATTACK
The movement of a wing with deflected ailerons close to a screen
[AD-A048651] N78-18004
A method for calculation of the pressure distribution of wing-body configurations for large angle of attack at subsonic speed — based on potential theory
[BMVG-FBWT-77-15] N78-18013
Laser velocimeter survey about a NACA 0012 wing at low angles of attack
[NASA-TM-74040] N78-18084
Inviscid, nonadiabatic flow fields over blunt, sonic corner bodies for outer planet entry conditions by a method of integral relations
[NASA-TP-1133] N78-18363
ANGLES [GEOMETRY]
Solar cell angular position transducer
[NASA-CASE-LAR-11999-1] N78-18394
ANGULAR DISTRIBUTION
Intensity, angular distribution and polarization of spontaneous molecular light scattering
[ESA-TT-438] N78-18298
ANGULAR MOMENTUM
Evaluation of a laboratory test model annular momentum control device
[NASA-TP-1142] N78-18252
ANIONS
Anion permselective membrane
[NASA-CR-135316] N78-18515
Photon interactions with atmospheric negative ions
[AD-A048315] N78-18611

ANISOTROPY
Residual stresses in an anisotropic thick hollow cylinder of chemically vapor-deposited material due to uniform coolsdown
[AD-A048301] N78-18465

ANODES
Reflex tetrode with unidirectional ion flow
[AD-A048751] N78-18336

ANODIC COATINGS
Characterization of chromic-acid anodized 2024-T3 aluminum adherends
[AD-A048756] N78-18199

ANTARCTIC REGIONS
Clinical and biochemical aspects of human adaptation to central Antarctica as applied to problems of space biology and medicine
N78-18746

ANTENNA ARRAYS
Design of microstrip disk antenna arrays
[NASA-TM-78631] N78-18263
Microstrip reflectarray antenna program
[AD-A048480] N78-18337

ANTENNA DESIGN
Optimization of the design parameters for a wide-band radiometric system
[NASA-TM-78662] N78-18117
Design of microstrip disk antenna arrays
[NASA-TM-78631] N78-18263

ANTENNA RADIATION PATTERNS
Pattern prediction of wire antennas on satellite structures
[AD-A048654] N78-18279
Numerical results for modified image theory quasi-static range subsurface-to-subsurface and subsurface-to-air propagation equations
[AD-A048345] N78-18286
Determination of antenna radiation patterns, radar cross sections and jam-to-signal ratios by flight tests
[NLR-MP-76023-U] N78-18289
A system analysis of the 13.3 GHz — antenna patterns and signal transmission
[NASA-CR-151627] N78-18496

ANTENNAS
Low profile antenna performance study. Part 3: Bibliography
[AD-A047991] N78-18273
Low profile antenna performance study. Part 2: Broadband antenna techniques survey
[AD-A047992] N78-18274
Near-field antenna measurements on a cylindrical surface: A source scattering-Matrix formulation
[PB-274938/0] N78-18287
Measurement of the impulse response of communication antennas
[AD-A048070] N78-18288

ANTHROPOMETRY
Selected design parameters for reclining seats based on engineering anthropometry
[AD-A048458] N78-18769

ANTIBODIES
Heterophilic antibodies and complement activity of rat blood serum after flight in Kosmos-605 satellite
N78-18731

ANTISEPTICS
Spacecraft disinfectant/cleansing agent development
[NASA-CR-151628] N78-18212

APERTURES
Clutter free synthetic aperture radar correlator
[NASA-CASE-NPO-14035-1] N78-18266
Synthetic aperture radar image processing techniques development and evaluation
[AD-A048193] N78-18269
Large-aperture optical modulator materials. Lead lanthanum zirconate titanate ceramic and lithium niobate crystal show promise as modulator materials for optical transmitters with up to 6-inch apertures
[AD-A048163] N78-18909

APEXES
Almost traceable graphs and traceability
N78-18832

APOGEE BOOST MOTORS
Program listing of an analytic mass model for chemical rocket stages
[DLR-IB-456-76/2] N78-18125

APOLLO SOYUZ TEST PROJECT
Investigation of space perception by the crew of the experimental Soyuz-Apollo mission
N78-18695

APOLLO 14 FLIGHT
Apollo 14 coarse fines [4-10 mm] sample location and classification
[NASA-TM-79348] N78-19020

APPLICATIONS OF MATHEMATICS
Filtering of non-linear instabilities
[NASA-CR-155779] N78-17996
Stress fields in composite laminates
[AD-A048565] N78-18139
Approximation of zeros of functions arising in the engineering sciences
[AD-A047783] N78-18846

APPLICATIONS PROGRAMS (COMPUTERS)
Application of minicomputers to studies in electroanalytical chemistry
N78-18148

APPROACH
The application of techniques for predicting STOL aircraft response to wind shear and turbulence during the landing approach
[UTIAS-215] N78-18077

APPROACH CONTROL
Benefits of MLS guidance for curved approaches. Volume 2: Operational benefits for New York Airports
[PB-274585/9] N78-18037
Concepts for determination of longitudinal separation standards on final approach
[PB-274590/9] N78-18038

APPROXIMATION
Theory of the galvanomagnetic properties of inhomogeneous metals: Application to copper
N78-18184
Improvement of modal methods for dynamic response problems of linear elastic structures
[DLR-FB-77-33] N78-18474
Approximation by algebraic numbers of bounded degree
N78-18835
Formal and computational studies of molecular collision dynamics
N78-18880

AQUIFERS
Saline-water intrusion in the Fernandina Beach area, Nassau County, Florida
[PB-274015/7] N78-18504

ARCHAEOLOGY
An example of appyling remote sensing to a Corps of Engineers archeological problem
[AD-A048106] N78-18503

ARCHITECTURE (COMPUTERS)
An exercise in software architectural design: From requirements to design problem structure
[AD-A048765] N78-18782
Simulation of packet communication architecture
[AD-A048290] N78-18783

ARGON LASERS
The Monte Carlo simulation of the Ladon photon beam facility — backward Compton scattering of argon laser light with storage ring electrons
[ISS-P-76/10] N78-18425

AROMATIC COMPOUNDS
Matrix isolation Fourier transform infrared spectroscopy of polycyclic aromatic hydrocarbons
N78-18146

ARROW WINGS
Theoretical evaluation of high speed aerodynamics for arrow wing configurations
[NASA-TM-78659] N78-17992

ARSENIDES
Investigation of laser optical biasing on the quantum transport properties of n-InSb
[AD-A048229] N78-18414

ARTIFICIAL GRAVITY
Biomechanical criteria of artificial gravity
N78-18682

ARTIFICIAL INTELLIGENCE
The inference of domain structure from informal process descriptions
[AD-A048154] N78-18825
Design of a production system for cognitive modelling number 1
[AD-A048196] N78-18826

ARTIFICIAL SATELLITES
An electro optical MTI system for the detection of artificial satellites [the NITH finder]
[AD-A048055] N78-18099
Pattern prediction of wire antennas on satellite structures
[AD-A048654] N78-18279

ASPHERICITY
High-speed fabrication of aspherical surfaces — for optical equipment
N78-18900

ASSATEAGUE ISLAND [MD-VA]
LANDSAT application of remote sensing to shoreline-form analysis — Cape Hatteras, Cape Lookout, and Assateague Island
[E78-10079] N78-18488

ASSEMBLING
Complex materials handling and assembly systems
[PB-274539/6] N78-18434
Complex materials handling and assembly systems
[PB-274540/4] N78-18435

ASSESS PROGRAM
Experiences with the ASSESS 2 lidar experiment
[DLR-IB-553-77/6] N78-18296

ASSURANCE
Guidelines for space materials selection
[ESA-PSS-07/QRM-01-ISSUE-3]
N78-18116

ASTRONAUT LOCOMOTION
Dynamics of cyclic and acyclic locomotion of the Soyuz-18 crew after a 63-day space mission
N78-18740
Spacesuit mobility joints
[NASA-CASE-ARC-11058-2] N78-18763

ASTRONAUTS
Psychopharmacology in aviation and astronautics
N78-18716

ASTRONOMICAL OBSERVATORIES
Pulkovo Observatory: An essay on its history and scientific activity
[NASA-TM-75083] N78-19012

ASTRONOMICAL SPECTROSCOPY
The 16 to 40 micron spectra of Jupiter and Venus — far infrared absorption of hydrogen and sulfuric acid
N78-19008

ASTRONOMY
Pulkovo Observatory: An essay on its history and scientific activity
[NASA-TM-75083] N78-19012

ATMOSPHERIC ATTENUATION
Interaction of electromagnetic and acoustic waves in a stochastic atmosphere
[NASA-CR-155746] N78-18275

ATMOSPHERIC CHEMISTRY
Photon interactions with atmospheric negative ions
[AD-A048315] N78-18611

ATMOSPHERIC CIRCULATION
A generalized computer program for primitive-equation models
[AD-A048481] N78-18613
Stratospheric warmings: Synoptic, dynamic and general-circulation aspects
[NASA-TP-1017] N78-18630
Venus stratospheric circulation: A diagnostic study
N78-19019

ATMOSPHERIC COMPOSITION
Multivariate analysis of atmospheric particulate composition and computer-controlled interference correction for ion-selective electrode measurements in a flowing stream
N78-18569
Size and composition of atmospheric particles in rural areas near Washington, D. C.
N78-18570

ATMOSPHERIC DIFFUSION
Users' instructions for the NASA/MSFC cloud-rise preprocessor program, version 6, and the NASA/MSFC multilayer diffusion program, version 6: Research version for Univac 1108 system
[NASA-CR-2945] N78-18573

ATMOSPHERIC HEATING
Stratospheric warmings: Synoptic, dynamic and general-circulation aspects
[NASA-TP-1017] N78-18630

ATMOSPHERIC MODELS
A generalized computer program for primitive-equation models
[AD-A048481] N78-18613
Low-level, atmospheric turbulence model for marine environments
[AD-A047980] N78-18633
Atmospheric simulation using stratified liquid models
[PB-274529/7] N78-18658

ATMOSPHERIC MOISTURE
Hydrological application of atmospheric vapour-flux analyses
[WMO-476] N78-18652

ATMOSPHERIC PHYSICS
EHF transfer and shielding properties of air: Summary of 1974-1977 activities
[AD-A048067] N78-18277

ATMOSPHERIC PRESSURE
Relationship between onset of altitude-decompression disorders in man and barometric pressure level during intensive physical exercise
N78-18758

ATMOSPHERIC REFRACTION
Application of a root finding method for tropospheric ducting produced by trilinear refractivity profiles
[AD-A047916] N78-18267

ATMOSPHERIC TEMPERATURE
Interaction of electromagnetic and acoustic waves in a stochastic atmosphere
[NASA-CR-155746] N78-18275
As-built design specification for the digital derivation of daily and monthly data bases from synoptic observations of temperature and precipitation for the People's Republic of China
[NASA-CR-151616] N78-18624
Practical use of transitional rules for forecasting the monthly mean temperature at De Bilt
[KNMI-V-290] N78-18648

ATMOSPHERIC TURBULENCE
The application of techniques for predicting STOL aircraft response to wind shear and turbulence during the landing approach
[UTIAS-215] N78-18077
Low-level, atmospheric turbulence model for marine environments
[AD-A047980] N78-18633
A dual Doppler radar study of the urban boundary layer: A summary of METROMEX results
[PB-275346/5] N78-18656

ATMOSPHERICS
The distribution of thunderstorm days, lightning discharges, and the incidence of lightning discharge derived from VLF sferics data
[AD-A048271] N78-18634
Application of Doppler weather radar to turbulence measurements which affect aircraft
[AD-A048603] N78-18641

ATOMIC ENERGY LEVELS
Double optical resonance — quantum electrodynamics and emission spectra from atomic excitations
N78-18901

ATOMIC EXCITATIONS
Double optical resonance — quantum electrodynamics and emission spectra from atomic excitations
N78-18901

ATOMIC STRUCTURE
Structure elucidation by nuclear magnetic resonance spectroscopy — bisbenzylisoquinoline alkaloids
N78-18145

ATOMIZING
Studies of atoms vaporized from individual solute particles in analytical flames
N78-18150

ATOMS
The two level atom of quantum optics
N78-18902

ATS 6
Energetic electrons at the synchronous altitude, 1974 - 1977
[NASA-CR-155775] N78-19025

ATTITUDE [INCLINATION]
Interferometer mirror tilt correcting system
[NASA-CASE-NPO-13687-1] N78-18391
Certain peculiarities of the functioning of the cardiovascular system in bedrest conditions during horizontal and antiorthostatic body positions
[NASA-TM-75075] N78-18699

ATTITUDE CONTROL
Analytical model of a single axis attitude roll control system
[SAND-77-8256] N78-18164

ATTITUDE STABILITY
Flight test of stick force stability in attitude-stabilized aircraft
[NLR-MP-77015-U] N78-18080

AUDIO EQUIPMENT
Interference to audio devices and receivers from signals near 27, 220 and 900 MHz
[PB-274887/9] N78-18879

AUDITORY PERCEPTION
Effects of high concentrations of carbon dioxide on function of the human acoustic analyzer
N78-18696

AUGER SPECTROSCOPY
Initial and final state effects in Auger and X-ray photoelectron spectroscopies
N78-18144
Silicon oxidation studied by electron spectroscopy
[LYCEN-7719] N78-18167

AURORAL ELECTROJETS
Geomagnetic data for March 1976 [AE [7] indices and stacked magnetograms]
[PB-275096/6] N78-18614
Geomagnetic data for February 1976 [AE [7] indices and stacked magnetograms
[PB-275095/8] N78-18615

AUSTENITIC STAINLESS STEELS
Stress corrosion and repassivation behavior of austenitic stainless steels in boiling MgCl2 solution
[ESA-TT-437] N78-18204
Activities of the Quantum Metrology Division
[NPL-QU-AR75] N78-18973

AUTOMATIC CONTROL
Digital computer control of advanced waste treatment systems
[PB-274859/8] N78-18999

AUTOMATIC TEST EQUIPMENT
A distributed hierarchical computer system for laboratory automation
N78-18812

AUTOMATION
Phase 1 of the automated array assembly task of the low cost silicon solar array project
[NASA-CR-155935] N78-18516

AUTOMOBILE ENGINES
Performance characteristics of automotive engines in the United States. Report no. 8: Mitsubishi Model 6DS7 diesel engine
[PB-274374/8] N78-18437
Performance characteristics of automotive engines in the United States. Report no. 9: Chrysler [1975] 225-CID 1-bbl engine
[PB-274375/5] N78-18438
Performance characteristics of automotive engines in the United States. Report no. 10: Chevrolet [1975] 250 CID 1-bbl engine
[PB-274376/3] N78-18439
Performance characteristics of automotive engines in the United States. Report no. 11: Chrysler [1975] 318-CID 2-bbl engine
[PB-274377/1] N78-18440

AUTOMOBILES
Alternative automotive engines and energy conservation
N78-18534
President Carter's automobile related energy conservation proposals
N78-18542
Potential for automotive fuel economy improvement
N78-18543

AUTONOMIC NERVOUS SYSTEM
The hematic system in the set of symptoms of autonomic disorders in monkeys on the low gravitation stand
N78-18757

AVALANCHE DIODES
Small-signal characteristics of gallium arsenide Schottky-Read IMPATT diodes
N78-18300
Manufacturing methods and technology engineering high-efficiency, high-power gallium arsenide read-type IMPATT diodes, volume 2
[AD-A048579] N78-18334
Manufacturing methods and technology engineering high-efficiency, high-power gallium arsenide read-type IMPATT diodes, volume 1
[AD-A048578] N78-18335

AVIONICS
The philosophy adopted for the flight testing of the Panavia Tornado avionics system in Hack aircraft
N78-18060
Digital Avionics Information System [DAIS]: Mid-1980's maintenance analysis
[AD-A047886] N78-18063
Palefac
[AD-A048331] N78-18065
Modular packaging approaches
[AD-A048205] N78-18321

AXIAL FLOW
Investigation of the unsteady pressure distribution on the blades of an axial flow fan
[NASA-CR-15571] N78-18068

AXIAL LOADS
The plane-strain general yielding of notched members due to combined axial force and bending. Volume 1: Wedge-shaped notches with large flank angles
[OUEL-1206/77-VOL-1] N78-18471

AXIAL STRESS
Biaxial testing of graphite/epoxy composites containing stress concentrations, part 2
[AD-A048659] N78-18140

AXISYMMETRIC FLOW
Split-operator, finite difference solution for axisymmetric laminar jet diffusion flames
[SAND-77-8502] N78-18079

AXONS
Nerve form and function: Some cellular aspects of action potential initiation and propagation
N78-18698

B

BACKSCATTERING
The Monte Carlo simulation of the Ladon photon beam facility — backward Compton scattering of argon laser light with storage ring electrons
[ISS-P-76/10] N78-18425

BACTERIA
Method and apparatus for eliminating luminol interference material
[NASA-CASE-MSC-16260-1] N78-18674

BALL BEARINGS
Statistical model for asperity-contact time fraction in elastohydrodynamic lubrication
[NASA-TP-1130] N78-18429
Positive commandable oiler for satellite bearing lubrication
N78-19035
Wear-resistant ball bearings for space applications
N78-19038

BANDWIDTH
Simulation of the 10-node data communication network operating with link speeds of 9.6 Kb/s
[NPL-COM-87] N78-18297
Independent gain and bandwidth control of a traveling wave maser
[NASA-CASE-NPO-13801-1] N78-18410

BANGLADESH
Investigations using data from LANDSAT 2 — Bangladesh
[E78-10080] N78-18489

BARORECEPTORS
Influence of central venous pressure upon sinus node responses to arterial baroreflex stimulation in man
[NASA-CR-155783] N78-18678
Influence of low and high pressure baroreceptors on plasma renin activity in humans
[NASA-CR-155307] N78-18701

BAYES THEOREM
Quadrature approximation of Bayesian recursive computations and the implementation of nonlinear estimators
N78-18794

BEACHES
The kinematics of breaking waves in the surf zone
[AD-A048723] N78-18666

BEAM LEADS
High Q selective filters using mechanical resonance of silicon beams
N78-18304

BEAM SPLITTERS
Over-under double-pass interferometer
[NASA-CASE-NPO-13999-1] N78-18395
Notes on design of high efficiency beam dividers for two beam infra-red interferometers
[NPL-QU-41] N78-18406

BEARING [DIRECTION]
An investigation of the bearing accuracy of two passive multi-channel array algorithms in the presence of correlated noise
N78-18791

BEARINGS
Magnetic bearing momentum wheels with magnetic gimballing capability for 3-axis active attitude control and energy storage
N78-19031

BED REST
Certain peculiarities of the functioning of the cardiovascular system in bedrest conditions during horizontal and antiorthostatic body positions
[NASA-TM-75075] N78-18699

BELGIUM
Report presented to the 20th COSPAR General Assembly
N78-18616

BENDING MOMENTS
The plane-strain general yielding of notched members due to combined axial force and bending. Volume 1: Wedge-shaped notches with large flank angles
[OUEL-1206/77-VOL-1] N78-18471
The plane-strain general yielding of notched members due to combined axial force and bending. Volume 2: Deep circular notches
[OUEL-1210/77-VOL-2] N78-18473

BENZENE
Two-photon absorption of molecular crystals and gas — napthalene, biphenyl, and benzene
N78-18950

BERYLLIUM
Thermal and electrical transport measurements in single crystal beryllium at low temperatures
N78-18952

BESSEL FUNCTIONS
Approximation of zeros of functions arising in the engineering sciences
[AD-A047783] N78-18846

BIBLIOGRAPHIES
Aeronautical Engineering: A special bibliography with indexes, supplement 91, January 1978
[NASA-SP-7037[91]] N78-17989
Index of ELDO publications
[ESA-SP-1006] N78-18102
Low profile antenna performance study. Part 3: Bibliography
[AD-A047991] N78-18273
Earth Resources: A continuing bibliography with indexes, issue 15, October 1977
[NASA-SP-7041[15]] N78-18481
Bibliography of statistical and meteorological methodology in weather modification, II
[AD-A048686] N78-18638
Aerospace Medicine and Biology: A continuing bibliography with indexes, supplement 175
[NASA-SP-7011[175]] N78-18677
Audio-visual proficiency testing: Annotated bibliography
[AD-A048122] N78-18704
File organisation and access techniques. A selective bibliography
[BLL-BLRDR-5414-[2113.56F]] N78-18981
Sanitary landfills: A bibliography, volume 2
[PB-274440/7] N78-19002

BINARY ALLOYS
The density, electrical resistivity and Hall coefficient of Li-B alloys
[AD-A048064] N78-18325

BINARY FLUIDS
Methods for the calculation of the value of the logarithm of the activity coefficient of a component at infinite dilution from binary vapour-liquid data
[NPL-CHEM-74] N78-18165

BINARY STARS
A spectroscopic investigation of the Be binary system phi Persei
N78-19011

BIOASSAY
Method and apparatus for eliminating luminol interference material
[NASA-CASE-MSC-16260-1] N78-18674

BIOELECTRIC POTENTIAL
Nerve form and function: Some cellular aspects of action potential initiation and propagation
N78-18698

BIOINSTRUMENTATION
Pacemaker related conductance changes in cardiac Purkinje fibers
N78-18697
RF dielectric properties measurement system: Human and animal data
[PB-274776/4] N78-18711

BIOLOGICAL EFFECTS
Aerospace Medicine and Biology: A continuing bibliography with indexes, supplement 175
[NASA-SP-7011(175)] N78-18677
Certain peculiarities of the functioning of the cardiovascular system in bedrest conditions during horizontal and antiorthostatic body positions
[NASA-TM-75075] N78-18699
Principal methods of simulating biological effects of weightlessness
N78-18739

BIOMEDICAL DATA
Biomechanical criteria of artificial gravity
N78-18682
Technique for selective catheterization of the heart and great vessels used in biomedical studies of healthy individuals
N78-18686

BIOSATELLITES
Morphological manifestations of functional changes in the hypothalamo-hypophyseal neurosecretory system and rat kidneys under the influence of space flight factors
N78-18690

BIOSYNTHESIS
Effect of prolonged space flight on protein biosynthesis in various rat organs and tissues
N78-18743

BIPOLAR TRANSISTORS
Modeling of high current injection into bipolar semiconductors
[AD-A048781] N78-18330

BISTATIC REFLECTIVITY
A two-scale scattering model with application to the JONSWAP '75 aircraft microwave scatterometer experiment
[NASA-CR-2919] N78-18662

BIVARIATE ANALYSIS
On a generalization of Freund's bivariate failure model
[AD-A048152] N78-18847

BLOOD
Design of a blood-freezing system for leukemia research
[NASA-TP-1165] N78-18673
Synthesis and biological screening of novel hybrid fluorocarbon hydrocarbon compounds for use as artificial blood substitutes
[NASA-CR-155781] N78-18702
Electrolyte content of blood and potassium ion transport in erythrocytes of animals exposed to a steady magnetic field
N78-18727
Effects of chronic exposure to carbon monoxide on biochemistry of human blood
N78-18748
Effect of superhigh intensity constant magnetic fields on morphological composition of peripheral blood
N78-18749
Changes in circulating blood volume and filling of the brain and internal organs of rats following acute and chronic hypoxia
N78-18756

BLOOD CIRCULATION
Distinctive features of regional circulation and vasomotor regulation following a two-month space flight
N78-18718
Studies of circulation during LBNP test aboard Salyut-4 orbital stations
N78-18719

BLOOD COAGULATION
Blood clotting function during 12-day immersion in water, and the preventive role of revolving on a centrifuge
N78-18733

BLOOD PLASMA
Influence of low and high pressure baroreceptors on plasma renin activity in humans
[NASA-CR-155307] N78-18701

BLOOD PRESSURE
Influence of central venous pressure upon sinus node responses to arterial baroreflex stimulation in man
[NASA-CR-155783] N78-18678

BLUNT BODIES
A procedure for the determination of the effect of fuselage nose bluntness on the wave drag of supersonic cruise aircraft
[NASA-CR-145306] N78-17994
Forebody and afterbody solutions of the Navier-Stokes equations for supersonic flow over blunt bodies in a generalized orthogonal coordinate system
[NASA-TP-1075] N78-18362
Inviscid, nonadiabatic flow fields over blunt, sonic corner bodies for outer planet entry conditions by a method of integral relations
[NASA-TP-1133] N78-18363

BODIES OF REVOLUTION
Drag, flow transition, and laminar separation on nine bodies of revolution having different forebody shapes
[AD-A048274] N78-18001
Hybrid structures of revolution
[AD-A047982] N78-18461

BODY CENTERED CUBIC LATTICES
Computer model for vacancy-surface interactions in bcc metals
N78-18180

BODY TEMPERATURE
The influence of the journey's time of day on the de- and resynchronization of the 24-hour rhythm of body and temperature after transatlantic flights
[ESA-TT-420] N78-18708

BODY-WING CONFIGURATIONS
A method for calculation of the pressure distribution of wing-body configurations for large angle of attack at subsonic speed — based on potential theory
[BMVG-FBWT-77-15] N78-18013
Flight tests of a radio-controlled airplane mode with a free-wing, free-canard configuration
[NASA-TM-72853] N78-18042

BOLOMETERS
NBS type 4 RF power meter operation and maintenance
[PB-274456/3] N78-18402

BOLTZMANN DISTRIBUTION
Boltzmann equation integration in thermionic converter conditions. Part 2: Terms in Boltzmann equation
[PPPL-1346-PT-2] N78-18939

BOLTZMANN TRANSPORT EQUATION
Boltzmann equation integration in thermionic converter conditions. Part 2: Terms in Boltzmann equation
[PPPL-1346-PT-2] N78-18939

BONE MARROW
Hemopoiesis in dogs exposed to lethal doses of protons with shielded bone marrow
N78-18728

BONE MINERAL CONTENT
Experimental and general theoretical research
N78-18717

BONES
Experimental and general theoretical research
N78-18717

BOOLEAN ALGEBRA
The analysis and synthesis of some advanced techniques for digital simulation
N78-18792
A separator theorem for planar graphs
[AD-A048786] N78-18872

BOOMS [EQUIPMENT]
Magnetometer deployment mechanism for Pioneer Venus
N78-19029
The GEOS-20 m Cable Boom Mechanism
N78-19040

BORN APPROXIMATION
Comparison between phase shift derived and exactly calculated nucleon-nucleon interaction matrix elements
N78-18893

BORON
Tensile stress-strain behavior of boron/aluminum laminates
[NASA-TP-1117] N78-18135
Boron combustion in combinatory propulsion
[DLR-IB-456-77/8] N78-18229

BORON ALLOYS
The density, electrical resistivity and Hall coefficient of Li-B alloys
[AD-A048064] N78-18325

BOUNDARY LAYER CONTROL
Phenomenological aspects of quasi-stationary controlled and uncontrolled three-dimensional flow separations
N78-18380

BOUNDARY LAYER EQUATIONS
Finite element solution to equations for turbulent motion and diffusion in planetary boundary layer
N78-18605

BOUNDARY LAYER SEPARATION
A theoretical investigation of the aerodynamics of low-aspect-ratio wings with partial leading-edge separation
[NASA-CR-145304] N78-17993
Three Dimensional and Unsteady Separation at High Reynolds Numbers
[AGARD-LS-94] N78-18375
Presentation of the subject
N78-18376
Separation problems encountered by aircraft designers ess Div. des Etudes Avancees.
N78-18377
Viscid-inviscid interaction methods for two-dimensional flows, including separation and shock waves
N78-18379
Introduction to unsteady aspects of separation in subsonic and transonic flow
N78-18381
Prediction of the severity of buffeting — wind tunnel tests
N78-18382
Some unsteady separation problems for slender bodies
N78-18383
Inviscid fluid models, based on rolled-up vortex sheets, for three-dimensional separation at high Reynolds number
N78-18384
Prediction of separation using boundary layer theory
N78-18386

BOUNDARY LAYER STABILITY
Some unsteady separation problems for slender bodies
N78-18383

BOUNDARY LAYER TRANSITION
Drag, flow transition, and laminar separation on nine bodies of revolution having different forebody shapes
[AD-A048274] N78-18001

BOUNDARY LAYERS
Ignition criteria for non-premixed stagnation point flow
N78-18352

BOUNDARY VALUE PROBLEMS
The geometrical theory of diffraction - a method for the solution of electromagnetic boundary value problems of complicated structures in the high frequency case — satellite and aircraft antennas
N78-18290
Boundary value problems and periodic solutions of nonlinear ordinary, functional and partial differential equations
[AD-A048170] N78-18850

BRAIN CIRCULATION
Changes in circulating blood volume and filling of the brain and internal organs of rats following acute and chronic hypoxia
N78-18756

BRAKING
An introduction to shuttle/LDEF retrieval operations: The R-bar approach option — orbital mechanics and braking schedule
[NASA-TM-78668] N78-18105

BREMSSTRAHLUNG
Laser absorption phenomena in flowing gas devices
[NASA-CR-135129] N78-18411

BRIDGES (STRUCTURES)
Nondestructive inspection of steel, phase 1
[PB-274495/1] N78-18445

BRITTLE MATERIALS
Impact damage in brittle materials in the plastic response regime
[AD-A048266] N78-18430

BRITTLENESS
Strength analysis of brittle materials
[AD-A048188] N78-18215

BROADBAND
Optimization of the design parameters for a wideband radiometric system
[NASA-TM-78662] N78-18117
Low profile antenna performance study. Part 3: Bibliography
[AD-A047991] N78-18273
Low profile antenna performance study. Part 2: Broadband antenna techniques survey
[AD-A047992] N78-18274
The characteristics of broadband, isotropic electrical field and magnetic field probes
[PB-274457/1] N78-18339

BROADCASTING
Concepts for the realization of TV broadcasting satellite
N78-18103

BUBBLE MEMORY DEVICES
Preliminary study of a data recorder with a magnetic bubble memory
[LETI/EPA/CRM-1248] N78-18405

BUBBLE TECHNIQUE
Magnetic LPE crystalline films for small bubble diameter cylindrical-domain memory applications
[AD-A048197] N78-18957

BUBBLES
Morphological studies of rising equatorial spread F bubbles
[AD-A048752] N78-18612

BUFFETING
Prediction of the severity of buffeting — wind tunnel tests
N78-18382

BUILDINGS
State solar energy legislation of 1976: A review of statutes relating to buildings
[PB-273899/5] N78-18567
Concorde noise-induced building vibrations John F. Kennedy International Airport
[NASA-TM-78660] N78-18873

BUNDLES
Equations of steady flow through slightly curved multifilament bundles
N78-18233

C

C BAND
C-band radar pulse Doppler error: Its discovery, modeling, and elimination
[NASA-TM-69366] N78-18265

C-130 AIRCRAFT
Standard electronic module radar cost analysis
[AD-A048207] N78-18319

C-135 AIRCRAFT
Standard electronic module radar cost analysis
[AD-A048207] N78-18319
C-141 AIRCRAFT
Standard electronic module radar cost analysis
[AD-A048207] N78-18319
CABLES [ROPES]
Cable strumming suppression
[AD-A047996] N78-18366
CADMIUM TELLURIDES
Study of HgCdTe MIS technology
[AD-A048224] N78-18954
CALCIUM CARBONATES
Investigation of magnetic water treatment devices -- - calcium carbonate scale retardation
N78-18987
CALCULUS
Effects of two calculus treatments upon achievement and critical thinking ability
N78-18833
CALENDARS
White Sands Missile Range climate calendar
[AD-A048305] N78-18639
CALIBRATING
A flight evaluation of a trailing anemometer for low-speed calibrations of airspeed systems on research aircraft
[NASA-TP-1135] N78-18044
CALIFORNIA
Uplink coverage measurements in the Los Angeles area for passive BCAS — collision avoidance
[AD-A048288] N78-18027
Analysis of requirements for accelerating the development of geothermal energy resources in California
[NASA-CR-155782] N78-18528
Heat flow in a geothermally active area: The Geysers, California
N78-18602
Earthquake resistance of earth and rock-fill dams. Report 5: Permanent displacements of earth embankments by Newark sliding block analysis
[AD-A048346] N78-18610
CAMBER
Cambered jet-flapped airfoil theory with tables and computer programs for application
[AD-A048528] N78-18006
CANARD CONFIGURATIONS
Flight tests of a radio-controlled airplane mode with a free-wing, free-canard configuration
[NASA-TM-72853] N78-18042
CANTILEVER BEAMS
Cantilever accelerometer
[AD-A048045] N78-18398
CAPACITANCE
Calculation of the per-unit length capacitance matrix for shielded insulated wires
[AD-A048174] N78-18324
CAPACITORS
Guidelines for the selection and application of tantalum electrolytic capacitors in highly reliable equipment
[NASA-TM-X-64755-REV-A] N78-18311
Solar energy storage subsystem utilizing latent heat of phase change
N78-18513
Method of measurement of rainfall intensity with the combined use of capacitor and tipping-bucket rain gauges
N78-18654
CAPE HATTERAS [NC]
LANDSAT application of remote sensing to shoreline-form analysis — Cape Hatteras, Cape Lookout, and Assateague Island
[E78-10079] N78-18488
CARBOHYDRATE METABOLISM
Lactate dehydrogenase isozymes of rat skeletal muscles following a space flight and with hypokinesia
N78-18689
CARBOHYDRATES
Carbohydrate and lipid content of rat liver tissue following a 22-day space flight
N78-18755
CARBON
Charcoal regeneration. Part 1: Mechanism of TNT adsorption
[AD-A048757] N78-18578
Thermodynamic properties of U[C,N] solid solutions and derived relationships among Thermodynamic excess properties
N78-18963
CARBON DIOXIDE
A sensor for the detection of CO2 in hyperbaric gaseous environments
[AD-A048599] N78-18400
A physically based climate model of hemispheric mean surface temperature with predictive capability
N78-18620
Effects of high concentrations of carbon dioxide on function of the human acoustic analyzer
N78-18696
Dynamic control of parameters of spacecraft atmosphere
N78-18725
Defense reactions of the organism while breathing high concentrations of carbon dioxide
N78-18734
Relaxation of the bending mode of carbon dioxide by vibration to rotation and vibration to vibration energy transfer
N78-18951
CARBON DIOXIDE LASERS
Laser absorption phenomena in flowing gas devices
[NASA-CR-135129] N78-18411
Electron number density measurement by ruby laser interferometry in a CO2 laser-induced gas breakdown plasma
[CONF-770725-1] N78-18938
CARBON FIBERS
Oxidative stabilization of acrylic fibers. 3: Stabilization dynamics
[AD-A048746] N78-18218
CARBON MONOXIDE
Studies of carbon monoxide and oxygen chemisorbed on palladium and related metals
N78-18173
Carbon monoxide
[PB-274965/3] N78-18713
Effects of chronic exposure to carbon monoxide on biochemistry of human blood
N78-18748
CARBON MONOXIDE POISONING
Effects of chronic exposure to carbon monoxide on biochemistry of human blood
N78-18748
CARBON STEELS
The effects of velocity on corrosion of galvanic couples in seawater
[AD-A048669] N78-18191
CARDIOGRAPHY
Pacemaker related conductance changes in cardiac Purkinje fibers
N78-18697
CARDIOVASCULAR SYSTEM
Autogenic training used for self-regulation of cardiovascular function and prevention of neurocirculatory dystonia in pilot candidates
N78-18694
Certain peculiarities of the functioning of the cardiovascular system in bedrest conditions during horizontal and antiorthostatic body positions
[NASA-TM-75075] N78-18699
Influence of low and high pressure baroreceptors on plasma renin activity in humans
[NASA-CR-155307] N78-18701
Cardiovascular reactions to orthostatic tests and human resistance to vestibular stimuli
N78-18724
CARGO
Measurement and simulation of fuel consumption in rail freight service
N78-18545
Passengers in containers
[NASA-TM-75078] N78-18989
CARGO AIRCRAFT
Energy and economic impacts of projected freight transportation improvements
N78-18537
CARRIER MOBILITY
Inversion layer carrier distribution and carrier effective mobility in metal-oxide-semiconductor devices
N78-18948
CASES [CONTAINERS]
Investigations of rocket propellants using tracers. Life testing of plastic propellant gases
[BMVG-FBWT-77-14] N78-18228
CAST ALLOYS
Microstructure stability of high temperature cast and forged alloys on Ni basis — gas turbine materials
N78-18201
CASTING
High strength aluminum casting technology: Squeeze casting of 7075 alloy
[AD-A048657] N78-18192
CATALYSTS
Analogies among active sites of coordinativelyunsaturated transition-metal complexes, surfaces and supported catalysts
[AD-A048289] N78-18197
CATARACTS
Cataractogenic effect of 25 and 50 MeV protons
N78-18751
CATHETERIZATION
Technique for selective catheterization of the heart and great vessels used in biomedical studies of healthy individuals
N78-18686
CAVITY RESONATORS
Theory and methods for modelling acoustically long, unpartitioned cavity resonators for engine exhaust systems
N78-18427
CDC 6000 SERIES COMPUTERS
NASTRAN stress recovery package
[AD-A048744] N78-18467
CELLULOSE
The treatment of cellulose by high pressure discharge — molecular structure modifications
N78-18221
CENTRIFUGAL COMPRESSORS
Investigation of the jet wake discharge flow of a heavily loaded centrifugal compressor impeller
[DLR-FB-77-32] N78-18073
CENTRIFUGAL FORCE
Study of an air lift pump in a centrifugal force field
[DLR-FB-77-40] N78-18436
CENTRIFUGES
Blood clotting function during 12-day immersion in water, and the preventive role of revolving on a centrifuge
N78-18733
CERAMIC COATINGS
Titanium diboride electrodeposited coatings
[AD-A047956] N78-18214
CERAMICS
Strength analysis of brittle materials
[AD-A048188] N78-18215
Survey of ceramic refractory problems and materials shortages
[AD-A048108] N78-18216
Microwave techniques for nondestructive evaluation of ceramics
[AD-A048582] N78-18443
Large-aperture optical modulator materials. Lead lanthanum zirconate titanate ceramic and lithium niobate crystal show promise as modulator materials for optical transmitters with up to 6-inch apertures
[AD-A048163] N78-18909
CH-47 HELICOPTER
Limitations of the CH-47 helicopter in performing terrain flying with external loads
[AD-A048580] N78-18054
CHANNELS [DATA TRANSMISSION]
Problems in designing a high-speed linear data bus for a multimicroprocessor system
[NPL-COM-89] N78-18817
CHARACTERIZATION
A new experimental method for the accelerated characterization of composite materials
[VPI-E-78-3] N78-18132
CHARCOAL
Charcoal regeneration. Part 1: Mechanism of TNT adsorption
[AD-A048757] N78-18578
CHARGE EXCHANGE
Exchange and relaxation effects in low-energy radiationless transitions
[NASA-TM-79383] N78-18882
CHARGED PARTICLES
Steady state radiative cooling rates for low-density high-temperature plasmas
[PPPL-1352] N78-18940
CHEMICAL ANALYSIS
Video fluorometry: A novel approach to the acquisition and interpretation of multicomponent fluorescence data
N78-18142
Microbeam analysis techniques for ICS
[AD-A048482] N78-18338
CHEMICAL ATTACK
Chemical degradation and stress-cracking of drawn poly[ethylene terephthalate] fibers
N78-18209
CHEMICAL BONDS
Theoretical studies of chemisorption
N78-18156
CHEMICAL COMPOSITION
Trace elemental characteristics of aerosols emitted from municipal incinerators
[NASA-TM-78630] N78-18572
CHEMICAL COMPOUNDS
Chemical use classification system
[PB-275106/3] N78-18129
CHEMICAL EQUILIBRIUM
Analytic solution for the equilibrium composition of a carbon-nitrogen-oxygen gas mixture
[AD-A048597] N78-18161
CHEMICAL LASERS
Investigation of laser optical biasing on the quantum transport properties of n-InSb
[AD-A048229] N78-18414
Parameter studies relative to an electric field-induced dipole moment laser
[AD-A048327] N78-18417
Chemical laser potential of selected group 4-A metal oxides
[AD-A048779] N78-18419
CHEMICAL PROPERTIES
The chemical, mechanical, and implant properties of glass-coated alumina
N78-18130
CHEMICAL PROPULSION
Preliminary design study of a propulsion platform for transport of Spacelab payloads — chemical propulsion
[DLR-IB-456/76-6] N78-18107
USAP - a universal standardized propulsion platform for the transport of Spacelab payloads
[DLR-IB-456/75-9] N78-18123
Program listing of an analytic mass model for chemical rocket stages
[DLR-IB-456-76/2] N78-18125

CHEMICAL REACTIONS
The synthesis and study of some novel organo-transition metal compounds
N78-18172
Study on the formation of reaction layers on metal surfaces by using lubricant additives
[DLR-FB-77-31] N78-18222
Chemically polished quartz — using ammonium bifluoride
[AD-A048077] N78-18958

CHEMICAL REACTORS
A system for delivering SiCl4 to a chemical reactor
[NASA-CASE-NPO-14383-1] N78-18253

CHEMILUMINESCENCE
Method and apparatus for eliminating luminol interference material
[NASA-CASE-MSC-16260-1] N78-18674

CHEMISORPTION
Theoretical studies of chemisorption
N78-18156
Studies of carbon monoxide and oxygen chemisorbed on palladium and related metals
N78-18173

CHEMISTRY
National Bureau of Standards Journal of Research, section A: Physics and Chemistry, volume 81A, numbers 2 and 3, March - June 1977
[PB-275037/0] N78-18169

CHINESE PEOPLES REPUBLIC
As-built design specification for the digital derivation of daily and monthly data bases from synoptic observations of temperature and precipitation for the People's Republic of China
[NASA-CR-151616] N78-18624

CHIPS [MEMORY DEVICES]
Preliminary study of a data recorder with a magnetic bubble memory
[LETI/EPA/CRM-1248] N78-18405

CHLOROSILANES
Synthesis of silane and silicon in a non-equilibrium plasma jet
[NASA-CR-155933] N78-18518

CHROMIC ACID
Characterization of chromic-acid anodized 2024-T3 aluminum adherends
[AD-A048756] N78-18199

CHROMIUM ALLOYS
NPL 7 creep damage in Ni-Cr base alloys
[NPL-DMA-246] N78-18202

CIRCADIAN RHYTHMS
The influence of the journey's time of day on the de- and resynchronization of the 24-hour rhythm of body and temperature after transatlantic flights
[ESA-TT-420] N78-18708

CIRCUITS
On the planarity of hypergraphs
[AD-A048051] N78-18318
Manufacturing Methods and Technology Engineering [MM and TE] program for the establishment of production techniques for high density thick film circuits used in crystal oscillators
[AD-A048602] N78-18331

CIRCULATORY SYSTEM
Tetrapolar rheography used to evaluate the circulatory system
N78-18754

CIVIL AVIATION
Continued investigation of potential application of Omega navigation to civil aviation
[NASA-CR-145307] N78-18028

CLASSICAL MECHANICS
Archives of mechanics, volume 29, issue 4
N78-18231
On the non-standard formulation of mechanics
N78-18237

CLASSIFICATIONS
Chemical use classification system
[PB-275106/3] N78-18129

CLEAR AIR TURBULENCE
EHF transfer and shielding properties of air: Summary of 1974-1977 activities
[AD-A048067] N78-18277

CLEAVAGE
Mechanism of cleavage fracture in pearlitic eutectoid steel
N78-18176

CLIMATE
A physically based climate model of hemispheric mean surface temperature with predictive capability
N78-18620
White Sands Missile Range climate calendar
[AD-A048305] N78-18639

CLIMATOLOGY
Stratospheric warmings: Synoptic, dynamic and general-circulation aspects
[NASA-TP-1017] N78-18630

CLOUD PHYSICS
Transactions of the 8th All-Union Conference on cloud physics and active modifications [selected articles]
[AD-A048653] N78-18637

CLOUD SEEDING
Atmospheric simulation using stratified liquid models
[PB-274529/7] N78-18658

CLUTTER
Clutter free synthetic aperture radar correlator
[NASA-CASE-NPO-14035-1] N78-18266
Radar fixed echo suppression by prefiltering at constant radiation direction
[FFM-257] N78-18295

CMOS
Cost and reliability aspects of large CMOS integrated circuits for fuzing applications
[AD-A048276] N78-18329

COAL
Pilot plant study of conversion of coal to low sulfur fuel
[PB-274113/0] N78-18565
Preliminary evaluation of sulfur variability in low-sulfur coals from selected mines
[PB-275000/8] N78-18566

COAL UTILIZATION
Clean coal combustion through coal washing and blending
[PB-274406/8] N78-18560

COASTAL ECOLOGY
Massachusetts coastal zone management program, volume 1
[PB-274031/4] N78-18667

COASTAL WATER
Sea surface temperature determination from infrared radiation. A critical evaluation of the method — coastal water circulation study
[KNMI-WR-77-5] N78-18669

COBALT ALLOYS
Investigation of processing microstructures and properties of oxide dispersion strengthened cobalt alloy extruced shapes
[AD-A048593] N78-18198

COBOL
COBOL compiler validation
[AD-A048319] N78-18779

COCKPITS
A comparison of integrated and conventional cockpit warning systems — pilot performance and reaction time in man machine systems
[AD-A048670] N78-18022
Selected design parameters for reclining seats based on engineering anthropometry
[AD-A048458] N78-18769

CODES
A computer code for the simulation of turbulent swirling flow through closed-conduit flow meters
[PB-274650/1] N78-18370
The STAGS computer code
[NASA-CR-2950] N78-18458

COEFFICIENTS
Methods for the calculation of the value of the logarithm of the activity coefficient of a component at infinite dilution from binary vapour-liquid data
[NPL-CHEM-74] N78-18165

COLD ACCLIMATIZATION
Clinical and biochemical aspects of human adaptation to central Antarctica as applied to problems of space biology and medicine
N78-18746

COLD WEATHER TESTS
Clinical and biochemical aspects of human adaptation to central Antarctica as applied to problems of space biology and medicine
N78-18746

COLLAGENS
Mucopolysaccharides and collagen of tissues in hypokinetic rats
N78-18723

COLLIMATORS
Holographic combiners for head-up displays
[AD-A047998] N78-18064

COLLISION AVOIDANCE
Uplink coverage measurements in the Los Angeles area for passive BCAS — collision avoidance
[AD-A048288] N78-18027
The impact of a proposed active BCAS on ATCBBS performance in the Washington, D. C., 1981 environment
[AD-A048589] N78-18032

COLLISIONS
Collision studies of gaseous molecular lasers
[AD-A048010] N78-18413

COLOR TELEVISION
Full color hybrid display for aircraft simulators — landing aids
[NASA-CASE-ARC-10903-1] N78-18083

COLORIMETRY
A maximal chromatic expansion method of mapping multichannel imagery into color space — North Dakota
[E78-10075] N78-18484

COMBINATORIAL ANALYSIS
A separator theorem for planar graphs
[AD-A048786] N78-18872

COMBUSTION
Clean coal combustion through coal washing and blending
[PB-274406/8] N78-18560
Proceedings of the 2nd stationary source combustion symposium. Volume 4. Fundamental combustion research
[PB-274029/8] N78-18584
Proceedings of the 2d Stationary Source Combustion Symposium. Volume 5: Addendum
[PB-274897/8] N78-18590

COMBUSTION CHAMBERS
GE core engine noise investigation, low emission engines
[AD-A048590] N78-18069
Use of fluid injection to regulate the combustion chamber pressure for unstably burning solid propellant combustion
[DLR-IB-456-77/4] N78-18124

COMBUSTION EFFICIENCY
Boron combustion in combinatory propulsion
[DLR-IB-456-77/8] N78-18229

COMBUSTION PRODUCTS
Trace elemental characteristics of aerosols emitted from municipal incinerators
[NASA-TM-78630] N78-18572
Compliance status of major air pollution facilities
[PB-275005/7] N78-18581

COMMAND AND CONTROL
World Wide Data Management System [WWDMS] self instruction manual, T-2 version, addendum B
[AD-A048478] N78-18784
Software acquisition management guidebook: Verification
[AD-A048577] N78-18807
An introduction to network job control language
[NPL-COM-88] N78-18809

COMMINUTION
A review of DOAE papers on mathematical models of attrition
[AD-A048609] N78-18861

COMMITTEE ON SPACE RESEARCH
Report presented to the 20th COSPAR General Assembly
N78-18616

COMMUNICATING
Information and technology transfer program for the National Science Foundation
[PB-274259/1] N78-18991

COMMUNICATION
What the next decade is going to bring
[NASA-TM-79361] N78-18976

COMMUNICATION EQUIPMENT
Measurement of the impulse response of communication antennas
[AD-A048070] N78-18288

COMMUNICATION NETWORKS
Survey: Automated Field Operations and Services [AFOS]
[NASA-CR-150548] N78-18261
Survey: Federal Aviation Administration National Communication Center
[NASA-CR-150552] N78-18262
NOAA/National Hurricane and Experimental Meteorological Laboratory
[NASA-CR-150550] N78-18627
Research on information system specification
[AD-A047864] N78-18977

COMMUNICATION SATELLITES
Concepts for the realization of TV broadcasting satellite
N78-18103
Rooftop antenna pointing program
[AD-A047999] N78-18111
Wideband satellite observations
[AD-A048801] N78-18282

COMMUTATION
Some problems concerning residual finiteness in algebras
N78-18837

COMPARATOR CIRCUITS
Window comparator
[NASA-CASE-FRC-10090-1] N78-18308

COMPENSATORS
Compensator improvement for multivariable control systems
N78-18820
The discrete-time compensated Kalman filter
[NASA-CR-2916] N78-18822

COMPILERS
COBOL compiler validation
[AD-A048319] N78-18779
FORTRAN compiler validation
[AD-A048317] N78-18780
FORTRAN complier validation summary report
[AD-A048353] N78-18781
The diagnostic facilities in ALGOL and FORTRAN compilers
[NPL-NAC-81] N78-18786

COMPLEXITY
Network reliability analysis: Algorithms and complexity
N78-18863

COMPOSITE MATERIALS
A new experimental method for the accelerated characterization of composite materials
[VPI-E-78-3] N78-18132
Third Conference on Fibrous Composites in Flight Vehicle Design, part 1
[NASA-TM-X-3377-PT-1] N78-18133
Third Conference on Fibrous Composites in Flight Vehicle Design, part 2
[NASA-TM-X-3377-PT-2] N78-18134

Structural analysis and testing for composite flywheel development
[AD-A048076] N78-18137
Biaxial testing of graphite/epoxy composites containing stress concentrations, part 2
[AD-A048659] N78-18140
Composites-analysis of non-homogeneous deformation of composite materials
[AD-A048430] N78-18141
Amalgam stabilization by selective interfacial amalgamation — polyacrylate dental cavity linings N78-18178

COMPOSITE STRUCTURES
Stress fields in composite laminates
[AD-A048565] N78-18139
Transient temperatures in laminated composite conical shells due to aerodynamic heating N78-18360

COMPRESSIBLE FLOW
Ignition criteria for non-premixed stagnation point flow N78-18352
Numerical solution of viscous-inviscid interaction problems in two-dimensional compressible flows based on the Navier-Stokes equations N78-18378

COMPRESSION LOADS
Evacuated load-bearing high performance insulation study
[NASA-CR-135342] N78-18251

COMPRESSION WAVES
Velocities of compressional wave in rocks of central California at high pressure and high temperature and applications to the study of the crustal structure of California coast ranges N78-18606

COMPRESSOR ROTORS
Compressor and fan wake characteristics
[NASA-CR-155766] N78-17995
Composite hub/metal blade compressor rotor
[NASA-CR-135343] N78-18131

COMPTON EFFECT
The Monte Carlo simulation of the Ladon photon beam facility — backward Compton scattering of argon laser light with storage ring electrons
[ISS-P-76/10] N78-18425
Models for X-ray and radio emission from clusters of galaxies N78-19006

COMPUTER DESIGN
Computer program for design and performance analysis of navigation-aid power systems. Program documentation. Volume 1: Software requirements document
[AD-A047925] N78-18558
Use of the MA-48L iterative analog computer in control system designing
[AD-A048559] N78-18827

COMPUTER GRAPHICS
Programmable in-raster symbol generator
[AD-A048596] N78-18333
General considerations on the design of an interactive system for data analysis
[AD-A048248] N78-18801
An application of interactive computer graphics technology to the design of dispersal mechanisms N78-19032

COMPUTER INFORMATION SECURITY
Design and abstract specification of a multics security kernel, volume 1
[AD-A048576] N78-18806

COMPUTER NETWORKS
Survey: Federal Aviation Administration National Communication Center
[NASA-CR-150552] N78-18262
Network versus linear programming algorithms and implementations
[AD-A048296] N78-18804
Generalized networks: A fundamental computer-based planning tool
[AD-A048297] N78-18814

COMPUTER PROGRAMMING
CAVE3: A general transient heat transfer computer code utilizing eigenvectors and eigenvalues
[NASA-CR-145290] N78-18359
Computing in store
[AD-A048053] N78-18799
Reliability evaluation of programmable read-only memories [PROMs], part 2
[AD-A048231] N78-18800
General considerations on the design of an interactive system for data analysis
[AD-A048248] N78-18801
The inference of domain structure from informal process descriptions
[AD-A048154] N78-18825
An algorithmic approach for reducing kinematically similar differential systems
[AD-A047781] N78-18845

COMPUTER PROGRAMS
Cambered jet-flapped airfoil theory with tables and computer programs for application
[AD-A048528] N78-18006
A simulation model for an enplaning-passenger-vehicle curbside at high-volume airports N78-18020
Improvement of flight measuring data with a Kalman filter
[BMVG-FBWT-77-6] N78-18057
Palefac
[AD-A048331] N78-18065
Orbit determination and orbit prediction from measured data using the ELKORR program
[DLR-IB-532-76/10] N78-18094
Rooftop antenna pointing program
[AD-A047999] N78-18111
Program listing of an analytic mass model for chemical rocket stages
[DLR-IB-456-76/2] N78-18125
Programmable in-raster symbol generator
[AD-A048596] N78-18333
Computer aided analysis of microwave electronic circuits in the frequency domain [ESAMEC]
[ESA-TT-441] N78-18341
Hybrid structures of revolution
[AD-A047982] N78-18461
Finite element capabilities in MIT Lincoln Laboratory version of STRUDL
[AD-A048605] N78-18466
JSME scatterometer data processing
[NASA-CR-151639] N78-18494
A computer analysis of heterojunction and graded bandgap solar cells N78-18512
A generalized computer program for primitive-equation models
[AD-A048481] N78-18613
Inductive extrapolation: A system for program synthesis from exemplary data employing regular grammar inference and polynomial separation of machine states N78-18789
A computer program for analyzing unresolved Mossbauer hyperfine spectra
[NASA-TM-78633] N78-18796
Short arc reduction of radar altimetry computer program
[NASA-CR-141434] N78-18798
Constraints in the design and implementation of interactive statistical systems for minicomputers
[AD-A048124] N78-18803
Software acquisition management guidebook: Verification
[AD-A048577] N78-18807
Verifying concurrent programs with shared data classes
[AD-A048637] N78-18808
The decision table approach to reliable software N78-18815
Applications programs for the waveform processing system
[AD-A048208] N78-18824
TSA: Statistical programs for interactive time series analysis
[AD-A048151] N78-18848
A survey on the state of research in automated scheduling of urban passenger transportation
[PB-274587/5] N78-19000

COMPUTER STORAGE DEVICES
Characterization and design of error correcting/detecting codes for asymmetric memories N78-18772
Magnetic LPE crystalline films for small bubble diameter cylindrical-domain memory applications
[AD-A048197] N78-18957
Optimal data storage and organization in computerized information processing systems subject to failures N78-18974

COMPUTER SYSTEMS DESIGN
Survey: Federal Aviation Administration National Communication Center
[NASA-CR-150552] N78-18262
As-built design specification for the digital derivation of daily and monthly data bases from synoptic observations of temperature and precipitation for the People's Republic of China
[NASA-CR-151616] N78-18624
Computing in store
[AD-A048053] N78-18799
Design and abstract specification of a multics security kernel, volume 1
[AD-A048576] N78-18806
An introduction to network job control language
[NPL-COM-88] N78-18809
A distributed hierarchical computer system for laboratory automation N78-18812
Generalized networks: A fundamental computer-based planning tool
[AD-A048297] N78-18814
Modular multicomputer systems with mini- and microprocessors. Military applicability and research activities
[FFM-246] N78-18816
Problems in designing a high-speed linear data bus for a multimicroprocessor system
[NPL-COM-89] N78-18817

COMPUTER SYSTEMS PROGRAMS
Flight test results of the strapdown hexad inertial reference unit [SIRU]. Volume 2: Test report
[NASA-TM-73223] N78-18025
The LARSYS educational package: Instructor's notes for use with the Data 100
[NASA-CR-151636] N78-18493
Computer program for design and performance analysis of navigation-aid power systems. Program documentation. Volume 1: Software requirements document
[AD-A047925] N78-18558
Fault-tolerant software for aircraft control systems
[NASA-CR-145298] N78-18797

COMPUTER TECHNIQUES
Computer technique for calculations of potential distribution in multidielectric media
[AD-A048057] N78-18323
Real-time computer techniques in the detection and analysis of severe storms from digital radar data N78-18622
Generalized networks: A fundamental computer-based planning tool
[AD-A048297] N78-18814
EDP network analysis for electronics in nuclear radiation environment
[BMVG-FBWT-77-13] N78-18899
A comparative evaluation of searching by controlled language and natural language in an experimental NASA data base
[ESA-CR[P]-1009] N78-18979

COMPUTERIZED DESIGN
Computer aided analysis of microwave electronic circuits in the frequency domain [ESAMEC]
[ESA-TT-441] N78-18341
Finite element capabilities in MIT Lincoln Laboratory version of STRUDL
[AD-A048605] N78-18466
Cartographic compilation study. Volume 1. System requirements and design analyses
[AD-A048220] N78-18501
Cartographic compilation study. Volume 2. Design specifications, Advanced Revision and Compilation System [ARCS]
[AD-A048221] N78-18502
Augmentation of a text retrieval system with an intelligent graphics terminal
[NPL-COM-86] N78-18980

COMPUTERIZED SIMULATION
A simulation model for an enplaning-passenger-vehicle curbside at high-volume airports N78-18020
The impact of a proposed active BCAS on ATCBBS performance in the Washington, D. C., 1981 environment
[AD-A048589] N78-18032
Computer model for vacancy-surface interactions in bcc metals N78-18180
Penetration of high explosives by inert projectiles — computerized simulation
[AD-A048326] N78-18227
Simulation code for underwater television systems [SCOUTS]
[AD-A048769] N78-18283
Simulation of the 10-node data communication network operating with link speeds of 9.6 Kb/s
[NPL-COM-87] N78-18297
Computer simulation of InP transferred-electron devices designed for Ka-band operation N78-18303
Statistical estimation theory applied to synchronous generator modeling N78-18306
Testing of turbulence models by exact numerical solution of the Navier-Stokes equations
[AD-A048199] N78-18365
A computer code for the simulation of turbulent swirling flow through closed-conduit flow meters
[PB-274650/1] N78-18370
Simulation of packet communication architecture
[AD-A048290] N78-18783
Application of sensitivity theory and optimization techniques to models of large scale systems N78-18864
Simulation of transmission electron micrographs for small dislocation loops N78-18904

COMPUTERS
Simulation of packet communication architecture
[AD-A048290] N78-18783
Numerical methods for the statistical analysis of random processes by means of computers
[NASA-TT-F-17159] N78-18795

CONCENTRATION (COMPOSITION)
Preliminary evaluation of sulfur variability in low-sulfur coals from selected mines
[PB-275000/8] N78-18566
Development of an unconventional approach to nitrification-dentrification
[PB-274398/7] N78-19003
Lunar sample analysis
[NASA-CR-151618] N78-19021

CONCENTRATORS
Focusing solar collector development
[PB-275042/0] N78-18561

CONCORDE AIRCRAFT
Concorde noise-induced building vibrations John F. Kennedy International Airport
[NASA-TM-78660] N78-18873

CONDUCTION
Transient, drift-dominated, bipolar conduction in dielectrics
N78-18302

CONDUCTIVE HEAT TRANSFER
Field equations for micropolar current and a heat conducting magnetically-saturated solid
N78-18239
Restrictions on heat conduction in simple materials
N78-18242
A Monte Carlo method of solving heat conduction problems
N78-18962

CONFERENCES
AIAA/MSFC Symposium on Space Industrialization: Proceedings
[NASA-CP-2026] N78-18088
Methods and standards for environmental measurement. Proceedings of the Materials Research Symposium
[PB-275008/1] N78-18128
Third Conference on Fibrous Composites in Flight Vehicle Design, part 1
[NASA-TM-X-3377-PT-1] N78-18133
Third Conference on Fibrous Composites in Flight Vehicle Design, part 2
[NASA-TM-X-3377-PT-2] N78-18134
Three Dimensional and Unsteady Separation at High Reynolds Numbers
[AGARD-LS-94] N78-18375
Effects of Energy Constraints on Transportation Systems
N78-18529
Proceedings of the 2d Stationary Source Combustion Symposium. Volume 5: Addendum
[PB-274897/8] N78-18590
What the next decade is going to bring
[NASA-TM-79361] N78-18976
Significant achievements in the planetary program, 1976 - 1977
[NASA-CR-2956] N78-19022
The 11th Aerospace Mechanisms Symposium
[NASA-TM-79350] N78-19026

CONGRESSIONAL REPORTS
Space shuttle, 1978
[GPO-99-072] N78-18106

CONICAL BODIES
Design and calibration of 5-point conical pressure probes for measuring in supersonic flow
[DLR-FB-77-28] N78-18015

CONICAL SHELLS
Transient temperatures in laminated composite conical shells due to aerodynamic heating
N78-18360

CONSCIOUSNESS
Sudden loss of consciousness in pilots with low intraocular pressure during exposure to G forces
N78-18737

CONSERVATION
Conservation districts and 208 water quality management: Non-point source identification and assessment, selection of best management practices, management agencies, regulatory programs
[PB-274411/8] N78-19001

CONSTANTS
Temperature dependence of the dielectric constant of quartz polymide
[AD-A047850] N78-18136

CONSTRUCTION MATERIALS
Fabrication of pressure tank using HY-100 steel
[AD-A048767] N78-18433

CONTAMINANTS
The 1976 NRL air quality data
[AD-A048750] N78-18579

CONTINENTAL SHELVES
Proposed increase in oil and gas leasing on the outer continental shelf, volume 1
[PB-273700/5] N78-18506
Proposed increase in oil and gas leasing on the outer continental shelf, volume 2
[PB-273701/3] N78-18507
Proposed increase in oil and gas leasing on the outer continental shelf, volume 3
[PB-273702/1] N78-18508
Environmental assessment of the Alaskan continental shelf. Northeast gulf of Alaska
[PB-275212/9] N78-18619
Hydraulic sensor instrumentation of a shore face in a tidal current convergence zone: Cape Henry, Virginia
[PB-275247/5] N78-18671

CONTINUITY
On continuous rings
N78-18870

CONTINUOUS RADIATION
Effects of gamma radiation on gallium-arsenide lasers
[AD-A048361] N78-18418

CONTINUOUS WAVE LASERS
Atomic fluorescence flame spectrometry with a continuous wave dye laser
N78-18409

CONTRACTS
Reliability, Improvement Warranty [RIW] mid contract evaluation
[AD-A048244] N78-18441

CONTROL
Applications of pattern recognition and learning controllers to power system analysis and control
N78-18819
Periodic optimization and controllability of periodic control systems
N78-18821

CONTROL BOARDS
Characterization of current tower cab environments
[AD-A048306] N78-18026

CONTROL CONFIGURED VEHICLES
Analytical study of ride smoothing benefits of control system configurations optimized for pilot handling qualities
[NASA-TP-1148] N78-18076

CONTROL EQUIPMENT
Evaluation of a laboratory test model annular momentum control device
[NASA-TP-1142] N78-18252
Optimal control of a large space telescope using an annular momentum control device
N78-18428
The 11th Aerospace Mechanisms Symposium
[NASA-TM-79350] N78-19026

CONTROL SURFACES
The movement of a wing with deflected ailerons close to a screen
[AD-A048651] N78-18004

CONTROL THEORY
Circulation control airfoil study — wind tunnel stability tests
[AD-A048677] N78-18005

CONTROL VALVES
Flexnozzle steering of a fluid jet
[FFA-MEMO-114] N78-18372

CONTROLLABILITY
The mount performance of the second GEODSS telescope
[AD-A048745] N78-18912

CONVERGENT NOZZLES
Mean velocity, turbulence intensity and turbulence convection velocity measurements for a convergent nozzle in a free jet wind tunnel. Comprehensive data report
[NASA-CR-135238] N78-17991

CONVEXITY
Convex riemannian manifolds of non-negative curvature
N78-18828

COOLING
Fundamental investigations on effusion cooling of turbine blades
[DLR-FB-77-39] N78-18074
Residual stresses in an anisotropic thick hollow cylinder of chemically vapor-deposited material due to uniform cool-down
[AD-A048301] N78-18465
Site dependent factors affecting the economic feasibility of solar powered absorption cooling
[NASA-CR-150533] N78-18524

COORDINATE TRANSFORMATIONS
Forebody and afterbody solutions of the Navier-Stokes equations for supersonic flow over blunt bodies in a generalized orthogonal coordinate system
[NASA-TP-1075] N78-18362

COPOLYMERS
Investigation of the T sub LL [T sub g] relaxation in homopolymers and block copolymers of styrene by torsional braid analysis
[AD-A048455] N78-18219

COPPER
Theory of the galvanomagnetic properties of inhomogeneous metals: Application to copper
N78-18184
Diffusion in a temperature gradient
N78-18346

CORRECTION
Application and comparison of modal perturbation methods and modal correction procedures exemplified by a swept wing with two external stores
[DLR-FB-77-21] N78-18014

CORRELATION
Prediction of transionospheric signal time delays using correlative techniques
[AD-A047917] N78-18268
Distribution of sample correlation coefficients
[AD-A048126] N78-18849

CORRELATION DETECTION
Clutter free synthetic aperture radar correlator
[NASA-CASE-NPO-14035-1] N78-18266

CORROSION
A study of the effect of velocity on corrosion of galvanic couples in seawater using a circling-foil apparatus
[AD-A048065] N78-18186
Accelerated laboratory corrosion test for materials and finishes used in naval aircraft
[AD-A048059] N78-18188
Investigation into the effect of dissimilar metal coupling, potential, and processing on the mode and distribution of galvanic corrosion attack on 5086 aluminum alloy in synthetic seawater
[AD-A048527] N78-18190
The effects of velocity on corrosion of galvanic couples in seawater
[AD-A048669] N78-18191
Investigation of processing microstructures and properties of oxide dispersion strengthened cobalt alloy extruced shapes
[AD-A048593] N78-18198
Mechanisms and kinetics of binary alkali silicate glass corrosion
N78-18207

CORROSION RESISTANCE
Investigation of magnetic water treatment devices -- - calcium carbonate scale retardation
N78-18987

COSMIC DUST
On relativistic dust grains and extensive air showers
[TRITA-EPP-77-17] N78-19017

COSMIC RAY SHOWERS
On relativistic dust grains and extensive air showers
[TRITA-EPP-77-17] N78-19017

COSMONAUTS
Dynamics of orthostatic stability of cosmonauts following 2 to 63 day missions
N78-18720
Some psychoneurological requirements in assessing inflight functional state of cosmonauts
N78-18721
Otolith system function in cosmonauts following space missions
N78-18736

COSMOS SATELLITES
Main objectives and results of the radiobiological experiment conducted on the Kosmos-690 biosatellite
N78-18688
Morphological manifestations of functional changes in the hypothalamo-hypophyseal neurosecretory system and rat kidneys under the influence of space flight factors
N78-18690
Histochemical study of digestive organs of rats following flight on Kosmos-605
N78-18722
DNA status in rat liver and spleen following flight on Kosmos-605 satellite
N78-18742
Vestibulotonic reflexes in muscles of the rat hind limb following a flight on Kosmos-605
N78-18745

COST ANALYSIS
Space shuttle, 1978
[GPO-99-072] N78-18106
SEAP - configuration and cost analysis — Spacelab experiment propulsion platform
[DLR-IB-456-77/2] N78-18108
Standard electronic module radar cost analysis
[AD-A048207] N78-18319
Cost benefit analysis of the transfer of NASA remote sensing technology to the state of Georgia
[E78-10076] N78-18485

COST EFFECTIVENESS
Reliability, Improvement Warranty [RIW] mid contract evaluation
[AD-A048244] N78-18441
Site dependent factors affecting the economic feasibility of solar powered absorption cooling
[NASA-CR-150533] N78-18524

COST ESTIMATES
Cost and reliability aspects of large CMOS integrated circuits for fuzing applications
[AD-A048276] N78-18329

COST REDUCTION
Research requirements to reduce maintenance costs of civil helicopters
[NASA-CR-145288] N78-17990

COULOMETRY
Real-time computer optimized scanning potential coulometry for multi-component trace analysis
N78-18152

COUNTERS
A network of lightning counters in the Netherlands
[KNMI-WR-77-6] N78-18647

COUPLERS
Applications of quantum electronics. Part 3: Holographic couplers for optical fibre bundles
[OUEL-1185/77-PT-3] N78-18919

COUPLING
Coupling of dissipative mechanisms of viscoplastic flow
N78-18238
Coupling of electromagnetic waves and space charge waves in type O traveling wave tubes
[NASA-TM-75249] N78-18309
Coupled-channel analysis for heavy-ion induced scattering and transfer reactions
N78-18894

COVARIANCE
Hypothesis testing for the parameters of a covariance matrix having linear structure
N78-18829

CRACK PROPAGATION
Calculation methods for fatigue life and crack propagation
N78-18049
Influence of microstructure on fatigue crack propagation rate of aluminium alloys
[ESA-TT-418] N78-18203
Estimating fatigue crack initiation and propagation lives in notched plates under variable loading histories
N78-18451

The determination of crack propagation curves with the aid of electron microscopy
[NLR-TR-75165-U] N78-18475
CRACKING [FRACTURING]
The development of fatigue/crack growth analysis loading spectra
N78-18048
Mechanism of cleavage fracture in pearlitic eutectoid steel
N78-18176
CRACKS
Finite deformation, elastic-plastic, finite element analysis of planar cracks
N78-18447
CREEP TESTS
NPL 7 creep damage in Ni-Cr base alloys
[NPL-DMA-246] N78-18202
CRITICAL POINT
Phase transitions and critical phenomena: Universality and global multicritical phase diagrams from position-space renormalization-group studies
N78-18945
CRITICAL PRESSURE
The pVT properties of acetic acid
[NPL-CHEM-76] N78-18166
CRITICAL TEMPERATURE
The pVT properties of acetic acid
[NPL-CHEM-76] N78-18166
CROP GROWTH
Analysis of data systems requirements for global crop production forecasting in the 1985 time frame
[NASA-TP-1164] N78-18497
CROP IDENTIFICATION
Cropland inventories using an orbital imaging radar
N78-18478
CROSS CORRELATION
A note on the dynamic correlation coefficient
[AD-A047654] N78-18985
CROSSLINKING
Effect of temperature and cross-linkings on the flow behavior of a rubberized epoxy resin
[UCRL-13732] N78-18220
CRUDE OIL
Proposed increase in oil and gas leasing on the outer continental shelf, volume 1
[PB-273700/5] N78-18506
Proposed increase in oil and gas leasing on the outer continental shelf, volume 2
[PB-273701/3] N78-18507
Proposed increase in oil and gas leasing on the outer continental shelf, volume 3
[PB-273702/1] N78-18508
CRUISE MISSILES
Lithergol dual propulsion for cruise missiles
[DLR-IB-76-7] N78-18122
CRUSTS
Neutron star crust-neutron superfluid frictional forces
N78-19010
CRYOGENIC EQUIPMENT
Peculiarities of the initial stage of a transient in a cryogenic system
N78-18250
Evacuated load-bearing high performance insulation study
[NASA-CR-135342] N78-18251
Development of cryogenic targets for laser fusion
[LA-UR-77-1523] N78-18936
CRYOGENIC FLUIDS
A multi-purpose cryostat for freezing biological materials
[OUEL-1195/77] N78-18255
CRYOGENICS
The 0.1m subsonic cryogenic tunnel at the University of Southampton
[NASA-CR-145305] N78-18086
CRYOSTATS
A multi-purpose cryostat for freezing biological materials
[OUEL-1195/77] N78-18255
CRYSTAL GROWTH
Study of radiation-hardened quartz production processes
[AD-A048264] N78-18317
Manufacturing methods and technology engineering high-efficiency, high-power gallium arsenide read-type IMPATT diodes, volume 1
[AD-A048578] N78-18335
Hot forming of silicon sheet, silicon sheet growth development for the large area silicon sheet task of the low cost silicon solar array project
[NASA-CR-155934] N78-18517
CRYSTAL OSCILLATORS
Manufacturing Methods and Technology Engineering [MM and TE] program for the establishment of production techniques for high density thick film circuits used in crystal oscillators
[AD-A048602] N78-18331
CRYSTAL STRUCTURE
Polarized infrared spectral studies of crystalline, hydrogen-bonded organic acids
[AD-A048587] N78-18162
Chemical degradation and stress-cracking of drawn poly[ethylene terephthalate] fibers
N78-18209
Archives of mechanics, volume 29, issue 4
N78-18231
CRYSTALLINITY
Experimental and general theoretical research
N78-18717
Electronic instability and change of crystalline phase in compounds of the V3Si type at low temperature
[NASA-TM-75178] N78-18953
CRYSTALS
Two-photon absorption of molecular crystals and gas — napthalene, biphenyl, and benzene
N78-18950
CULTIVATION
Investigation of concomitant microflora in prolonged substrate-free cultivation of beet plants
N78-18729
CURRENT AMPLIFIERS
An electric current preamplifier associated to the cathodic planes of proportional multiwire chambers
[LYCEN-7705] N78-18342
CURVATURE
Convex riemannian manifolds of non-negative curvature
N78-18828
CURVES
Almost traceable graphs and traceability
N78-18832
CYBERNETICS
The discrete-time compensated Kalman filter
[NASA-CR-2916] N78-18822
CYCLONES
Tropical cyclone research by data compositing
[AD-A048168] N78-18635
CYLINDRICAL BODIES
Cylinder drag at low Reynolds number
N78-18347
Residual stresses in an anisotropic thick hollow cylinder of chemically vapor-deposited material due to uniform cool-down
[AD-A048301] N78-18465
CYLINDRICAL CHAMBERS
An experimental determination of the history of formation of the cylinder averaged oxides of nitrogen in diesel combustion
N78-18143
CYLINDRICAL SHELLS
Plane-strain general yielding of a pressurised cylindrical shell containing a long part-through notch
[OUEL-1199/77] N78-18470
CYTOLOGY
Cytochemical studies of proteins and RNA in individual spinal cord motoneurons and spinal ganglia neurons of rats following a space flight
N78-18744

D

DAMAGE
NPL 7 creep damage in Ni-Cr base alloys
[NPL-DMA-246] N78-18202
DAMPING
The application of invariant imbedding to problems in elastic stability
N78-18453
Stiffness and damping of elastomeric O-ring bearing mounts
[NASA-CR-135328] N78-18460
DAMS
Earthquake resistance of earth and rock-fill dams. Report 5: Permanent displacements of earth embankments by Newark sliding block analysis
[AD-A048346] N78-18610
DATA ACQUISITION
Video fluorometry: A novel approach to the acquisition and interpretation of multicomponent fluorescence data
N78-18142
Sensors Workshop summary report
[NASA-TM-74978] N78-18498
Four versatile MIDAS compatible modules
[PB-274453/0] N78-18785
The determination of symmetrical spherical harmonic distributions from limited data — member of satellite-borne particle telescopes
[ESA-TM-178] N78-18862
DATA BASES
Cartographic compilation study. Volume 1. System requirements and design analyses
[AD-A048220] N78-18501
Cartographic compilation study. Volume 2. Design specifications, Advanced Revision and Compilation System [ARCS]
[AD-A048221] N78-18502
As-built design specification for the digital derivation of daily and monthly data bases from synoptic observations of temperature and precipitation for the People's Republic of China
[NASA-CR-151616] N78-18624
An exercise in software architectural design: From requirements to design problem structure
[AD-A048765] N78-18782
A comparative evaluation of searching by controlled language and natural language in an experimental NASA data base
[ESA-CR[P]-1009] N78-18979
DATA COMPRESSION
Cluster compression algorithm: A joint clustering/data compression concept
[NASA-CR-155780] N78-18495
Bounds and techniques for linear source coding
N78-18773
Quantization of image transforms with minimum distortion
[PB-274533/9] N78-18788
DATA LINKS
Programmable Data Terminal Set [PDTS] UHF test with AN/WSC-3 radio. Operational capability of PDTS is demonstrated
[AD-A048295] N78-18281
DATA MANAGEMENT
Survey: Federal Aviation Administration National Communication Center
[NASA-CR-150552] N78-18262
World Weather Watch. International global data-processing system plan to support the first GARP global experiment
[WMO-469] N78-18651
Automatic generation of segmentation directives on the CDC 6600 computer
[AD-A047782] N78-18777
An exercise in software architectural design: From requirements to design problem structure
[AD-A048765] N78-18782
World Wide Data Management System [WWDMS] self instruction manual, T-2 version, addendum B
[AD-A048478] N78-18784
DATA PROCESSING
PHAROS, processor for harmonic analysis of the response of oscillating surfaces — Wind tunnel models
[NLR-MP-77012-U] N78-18019
Processing EMP-related flash X-ray test data with the TRANS2 computer program
[AD-A048159] N78-18276
JSME scatterometer data processing
[NASA-CR-151639] N78-18494
Sensors Workshop summary report
[NASA-TM-74978] N78-18498
SESAME/Environmental Research Laboratories
[NASA-CR-150551] N78-18628
World Weather Watch. International global data-processing system plan to support the first GARP global experiment
[WMO-469] N78-18651
Applications programs for the waveform processing system
[AD-A048208] N78-18824
Accessing numeric data via flags and tags: A final report on a real world experiment
[NASA-TM-79326] N78-18975
HUD/PTI Information Systems Improvement Program. An orientation to comprehensive information systems improvement for a local government
[PB-274177/5] N78-18994
HUD/PTI Information Systems Improvement Program: Transfer analysis methodology guide
[PB-274178/3] N78-18995
HUD/PTI Information Systems Improvement Program: Information systems analysis methodology guide
[PB-274180/9] N78-18997
DATA PROCESSING EQUIPMENT
Four versatile MIDAS compatible modules
[PB-274453/0] N78-18785
DATA PROCESSING TERMINALS
Programmable Data Terminal Set [PDTS] UHF test with AN/WSC-3 radio. Operational capability of PDTS is demonstrated
[AD-A048295] N78-18281
DATA RECORDERS
Preliminary study of a data recorder with a magnetic bubble memory
[LETI/EPA/CRM-1248] N78-18405
DATA REDUCTION
The LARSYS educational package: Instructor's notes for use with the Data 100
[NASA-CR-151636] N78-18493
Cluster compression algorithm: A joint clustering/data compression concept
[NASA-CR-155780] N78-18495
Specklegram data reduction using optical and digital techniques
[AD-A048210] N78-18907
DATA RETRIEVAL
Indexing of structural data on chemical compounds in British universities
[BLL-BLRDR-5355-[2113.56F]]
N78-18982
DATA STORAGE
WALSHSTORE: The application of burst processing to fail-soft storage systems using Walsh transforms
[AD-A047889] N78-18774
Field electron and ion source research for high density information storage system
[AD-A048200] N78-18776

Computing in store
[AD-A048053] N78-18799

DATA SYSTEMS
Cluster compression algorithm: A joint clustering/data compression concept
[NASA-CR-155780] N78-18495
Analysis of data systems requirements for global crop production forecasting in the 1985 time frame
[NASA-TP-1164] N78-18497

DATA TRANSMISSION
Multipath over LOS channels study
[AD-A048175] N78-18271
Design study of a serial digital interface based on fiber optics
[ESA-CR[P]-1008] N78-18916

DECISION MAKING
The decision table approach to reliable software
N78-18815
An experiment on executive decision making
[AD-A047888L] N78-18970
HUD/PTI Information Systems Improvement Program, Chief Executive's overview
[PB-274207/0] N78-18990
HUD/PTI Information Systems Improvement Program: Transfer analysis methodology guide
[PB-274178/3] N78-18995

DECISION THEORY
Generalized stochastic network and statistical decision analysis
N78-18856
Selecting analytic approaches for decision situations Volume 1. Overview of the methodology
[AD-A047965] N78-18966
Selecting analytic approaches for decision situations Volume 2. Case studies — foreign policy and defense industries
[AD-A047880] N78-18967
Selecting analytic approaches for decision situations Volume 3. Appendices
[AD-A048228] N78-18968

DECISIONS
Algorithmic undecidability
N78-18838

DECODERS
PSK demodulator. Study report on a demodulator for onboard telemetry decoder
[ESA-CR[P]-968] N78-18114

DEFECTS
Failure analysis of pressure vessels with defects
[OUEL-1209/77] N78-18472

DEFENSE INDUSTRY
Selecting analytic approaches for decision situations Volume 2. Case studies — foreign policy and defense industries
[AD-A047880] N78-18967

DEFLECTION
Deflected heated water jets, theory and experiments
N78-18354
Nonlinear dynamic analysis of flat plate layered bodies accounting for large transverse deflections
N78-18452

DEGRADATION
Chemical degradation and stress-cracking of drawn poly(ethylene terephthalate) fibers
N78-18209

DELAWARE
New Castle County Delaware River shoreline study
[PB-275317/6] N78-18670

DELIVERY
A system for delivering SiCl4 to a chemical reactor
[NASA-CASE-NPO-14383-1] N78-18253

DEMAND [ECONOMICS]
A study of the energy consequences of alternative transport policies in intercity freight markets
N78-18547
Data needs in transportation energy conservation research
N78-18554

DEMODULATORS
PSK demodulator. Study report on a demodulator for onboard telemetry decoder
[ESA-CR[P]-968] N78-18114

DENSITY [MASS/VOLUME]
The pVT properties of acetic acid
[NPL-CHEM-76] N78-18166

DENSITY DISTRIBUTION
An examination of combined free and forced convection phenomena in a density-stratified fluid
N78-18353

DENSITY MEASUREMENT
Momentum distributions and one-body density matrices of the quantum fluids
N78-18348

DENTISTRY
Amalgam stabilization by selective interfacial amalgamation — polyacrylate dental cavity linings
N78-18178

DEOXYRIBONUCLEIC ACID
DNA status in rat liver and spleen following flight on Kosmos-605 satellite
N78-18742

DEPOLARIZATION
Pacemaker related conductance changes in cardiac Purkinje fibers
N78-18697

DEPOSITION
Industrial ion source technology — for ion beam etching, surface texturing, and deposition
[NASA-CR-135353] N78-18883

DESCRIPTIONS
Polarized light: Definitions and nomenclature
[NPL-MOM-25] N78-18921

DESIGN ANALYSIS
Fatigue design of fighters: Guidelines for obtaining and maintaining adequate fatigue performance of tactical aircraft
[AGARD-AG-231] N78-18046
Fatigue design of fighters; guidelines for obtaining and maintaining adequate fatigue performance of tactical aircraft: General survey
N78-18047
Modern concepts for aerodynamic rotor design
[DLR-IB-151-77/11] N78-18058
Substructuring methods for design sensitivity analysis and structural optimization
N78-18230
The design and evaluation of a two-phase turbine for low quality steam-water mixtures
N78-18426

DESULFURIZING
Pilot plant study of conversion of coal to low sulfur fuel
[PB-274113/0] N78-18565

DETONATION
Penetration of high explosives by inert projectiles — computerized simulation
[AD-A048326] N78-18227

DEUTERIUM
Electromigration of hydrogen and deuterium in vanadium, niobium and tantalum
N78-18177
Subsonic gas target 14 MeV neutron generator
N78-18896

DIAGNOSIS
Significance of the percussion symptom in detection of peptic ulcers in flight personnel
N78-18693
The diagnostic facilities in ALGOL and FORTRAN compilers
[NPL-NAC-81] N78-18786

DICHLORODIPHENYLTRICHLOROETHANE
DOT behavior of waxed mixtures pf RDX, HMX, and tetryl
[AD-A047968L] N78-18225

DICHROISM
Microwave dichroic plate
[NASA-CASE-GSC-12171-1] N78-18313

DIELECTRIC PROPERTIES
Temperature dependence of the dielectric constant of quartz polymide
[AD-A047850] N78-18136
RF dielectric properties measurement system: Human and animal data
[PB-274776/4] N78-18711

DIELECTRICS
Transient, drift-dominated, bipolar conduction in dielectrics
N78-18302
Computer technique for calculations of potential distribution in multidielectric media
[AD-A048057] N78-18323

DIESEL ENGINES
An experimental determination of the history of formation of the cylinder averaged oxides of nitrogen in diesel combustion
N78-18143
Performance characteristics of automotive engines in the United States. Report no. 8: Mitsubishi Model 6DS7 diesel engine
[PB-274374/8] N78-18437

DIESEL FUELS
Comparison tests on the 100-GPM electrokinetic fuel decontaminator and a 100-GPM military standard filter/separator
[AD-A048655] N78-18226

DIFFERENTIAL CALCULUS
Orbit determination and orbit prediction from measured data using the ELKORR program
[DLR-IB-552-76/10] N78-18094
A note on the stability regions of the backwards differentiation methods
[TRITA-NA-7708] N78-18855

DIFFERENTIAL EQUATIONS
An algorithmic approach for reducing kinematically similar differential systems
[AD-A047781] N78-18845
Approximation of zeros of functions arising in the engineering sciences
[AD-A047783] N78-18846

DIFFERENTIATORS
Window comparator
[NASA-CASE-FRC-10090-1] N78-18308

DIFFUSION
Diffusion in dislocation fields
N78-18248
Diffusion in a temperature gradient
N78-18346

DIFFUSION COEFFICIENT
Split-operator, finite difference solution for axisymmetric laminar jet diffusion flames
[SAND-77-8502] N78-18079
Analysis of the usefulness of diffusion equations for the description of dislocation mobility and related phenomena
N78-18232

DIFFUSION WAVES
Finite element solution to equations for turbulent motion and diffusion in planetary boundary layer
N78-18605

DIGESTIVE SYSTEM
Histochemical study of digestive organs of rats following flight on Kosmos-605
N78-18722

DIGITAL COMPUTERS
Palefac
[AD-A048331] N78-18065
Hardware verification
[AD-A048684] N78-18778
Digital computer control of advanced waste treatment systems
[PB-274859/8] N78-18999

DIGITAL DATA
A maximal chromatic expansion method of mapping multichannel imagery into color space — North Dakota
[E78-10075] N78-18484
Real-time computer techniques in the detection and analysis of severe storms from digital radar data
N78-18622

DIGITAL NAVIGATION
The philosophy adopted for the flight testing of the Panavia Tornado avionics system in Hack aircraft
N78-18060

DIGITAL SIMULATION
Cartographic compilation study. Volume 1. System requirements and design analyses
[AD-A048220] N78-18501
Cartographic compilation study. Volume 2. Design specifications, Advanced Revision and Compilation System [ARCS]
[AD-A048221] N78-18502
The analysis and synthesis of some advanced techniques for digital simulation
N78-18792

DIGITAL SYSTEMS
Digital Avionics Information System [DAIS]: Mid-1980's maintenance analysis
[AD-A047886] N78-18063
A digital frequency-offset lock system designed for use with stabilized lasers
[NPL-QU-40] N78-18424

DIGITAL TECHNIQUES
Bounds and techniques for linear source coding
N78-18773
Specklegram data reduction using optical and digital techniques
[AD-A048210] N78-18907

DIGITAL TO ANALOG CONVERTERS
Four versatile MIDAS compatible modules
[PB-274453/0] N78-18785

DIPOLE ANTENNAS
Numerical results for modified image theory quasi-static range subsurface-to-subsurface and subsurface-to-air propagation equations
[AD-A048345] N78-18286

DIPOLE MOMENTS
Parameter studies relative to an electric field-induced dipole moment laser
[AD-A048327] N78-18417

DISCRETE ADDRESS BEACON SYSTEM
Uplink coverage measurements in the Los Angeles area for passive BCAS — collision avoidance
[AD-A048288] N78-18027

DISCRETE FUNCTIONS
Studies in application of discrete ordinates transport methods to light transport calculations: Preparation of Mie theory cross sections in Legendre polynomials
[AD-A048614] N78-18913

DISCRIMINATORS
Amplification and discrimination of signals from proportional multiwire chambers
[ISS-T-76/6] N78-18344

DISLOCATIONS [MATERIALS]
Archives of mechanics, volume 29, issue 4
N78-18231
Analysis of the usefulness of diffusion equations for the description of dislocation mobility and related phenomena
N78-18232
Disclination kinematics
N78-18241
Forces in material Space
N78-18246
Diffusion in dislocation fields
N78-18248
Self-similar solutions of dislocation group dynamics and its application to aseismic faulting processes
N78-18448
Simulation of transmission electron micrographs for small dislocation loops
N78-18904

DISORDERS
The hematic system in the set of symptoms of autonomic disorders in monkeys on the low gravitation stand
N78-18757

Relationship between onset of altitude-decompression disorders in man and barometric pressure level during intensive physical exercise
N78-18758

DISPLACEMENT
Theory of disclinations in elastic Cosserat media
N78-18234

DISPLAY DEVICES
Liquid crystal airborne display
[AD-A048198] N78-18062
Full color hybrid display for aircraft simulators — landing aids
[NASA-CASE-ARC-10903-1] N78-18083
Programmable in-raster symbol generator
[AD-A048596] N78-18333
A system and method for obtaining wide screen schlieren photographs
[NASA-CASE-NPO-14174-1] N78-18396
WISP information display system user's manual
[NASA-CR-150541] N78-18623
Augmentation of a text retrieval system with an intelligent graphics terminal
[NPL-COM-86] N78-18980

DISTRIBUTION FUNCTIONS
Boltzmann equation integration in thermionic converter conditions. Part 2: Terms in Boltzmann equation
[PPPL-1346-PT-2] N78-18939

DISTRICT OF COLUMBIA
The impact of a proposed active BCAS on ATCBBS performance in the Washington, D. C., 1981 environment
[AD-A048589] N78-18032

DIVERGENT NOZZLES
Flexnozzle steering of a fluid jet
[FFA-MEMO-114] N78-18372

DOMESTIC ENERGY
SIMS prototype system 1 test results: Engineering analysis
[NASA-CR-150522] N78-18527

DOPPLER EFFECT
Laser pulse speckle effects
[AD-A048598] N78-18421

DOPPLER RADAR
Application of Doppler weather radar to turbulence measurements which affect aircraft
[AD-A048603] N78-18641
A dual Doppler radar study of the urban boundary layer: A summary of METROMEX results
[PB-275346/5] N78-18656

DOUBLE BASE ROCKET PROPELLANTS
Investigations of rocket propellants using tracers. Life testing of plastic propellant gases
[BMVG-FBWT-77-14] N78-18228

DRAG
Cylinder drag at low Reynolds number
N78-18347

DUAL THRUST NOZZLES
Lithergol dual propulsion for cruise missiles
[DLR-IB-76-7] N78-18122

DUCTILITY
Ductile fracture initiation in pure alpha-FE
N78-18181

DYE LASERS
Atomic fluorescence flame spectrometry with a continuous wave dye laser
N78-18409

DYNAMIC CHARACTERISTICS
Determination of dynamic characteristics from flight test data
[ESA-TT-434] N78-18081
Application of sensitivity theory and optimization techniques to models of large scale systems
N78-18864

DYNAMIC CONTROL
Dynamic control of parameters of spacecraft atmosphere
N78-18725

DYNAMIC MODELS
A physically based climate model of hemispheric mean surface temperature with predictive capability
N78-18620

DYNAMIC PROGRAMMING
On the use of matrix factorization techniques in penalty function methods for structured linear programs
[IIASA-RM-77-21] N78-18810
A note on the dynamic correlation coefficient
[AD-A047654] N78-18985

DYNAMIC RESPONSE
A theory for longitudinal wave propagation in a composite rod: A model for linear elastodynamic behavior of composite penetrators
[AD-A048552] N78-18285
The nonlinear response and stability of rotating shells
N78-18457
Dynamic response of a submerged elastic structure with elastic structures attached to it by inelastic springs
[AD-A048166] N78-18463
Improvement of modal methods for dynamic response problems of linear elastic structures
[DLR-FB-77-33] N78-18474
Oceanographic station data collected aboard R/V Melville during FDRAKE 75
[PB-274442/3] N78-18668

DYNAMIC STABILITY
The nonlinear response and stability of rotating shells
N78-18457

DYNAMIC STRUCTURAL ANALYSIS
Technical characteristics and working conditions of long-term orbiting Salyut-type space stations
[NASA-TM-75058] N78-18097

DYNAMIC TESTS
Determination of dynamic characteristics from flight test data
[ESA-TT-434] N78-18081
Evaluation of postural mechanisms under dynamic conditions
[NASA-CR-151638] N78-18700

DYNAMOMETERS
Performance characteristics of automotive engines in the United States. Report no. 9: Chrysler [1975] 225-CID 1-bbl engine
[PB-274375/5] N78-18438

E

EARTH [PLANET]
Low-speed impact phenomena and orbital resonances in the moon- and planet-building process
[NASA-CR-155310] N78-19016

EARTH ORBITS
JASON laser propulsion study, summer 1977
[AD-A047901] N78-18412

EARTH RESOURCES
Quick-look capability in a European earth resources satellite data network. Volume 2: Appendices 5 to 7
[FU15-4-VOL-2-APP-5-7] N78-18505

EARTH RESOURCES PROGRAM
Earth Resources: A continuing bibliography with indexes, issue 15, October 1977
[NASA-SP-7041[15]] N78-18481

EARTH ROTATION
Systems for the determination of polar motion
[PB-274698/0] N78-18617

EARTH SURFACE
Ellipticity of 0.4 to 2.4 Hertz Rayleigh waves with application to the study of near surface earth structure
N78-18600

EARTHQUAKE RESISTANT STRUCTURES
Earthquake resistance of earth and rock-fill dams. Report 5: Permanent displacements of earth embankments by Newark sliding block analysis
[AD-A048346] N78-18610

ECHO SUPPRESSORS
Radar fixed echo suppression by prefiltering at constant radiation direction
[FFM-257] N78-18295

ECONOMIC ANALYSIS
Manganese - 1977
[PB-274070/2] N78-18205
Passengers in containers
[NASA-TM-75078] N78-18989

ECONOMIC FACTORS
Analysis of requirements for accelerating the development of geothermal energy resources in California
[NASA-CR-155782] N78-18528
Electrification of railroads problems-potentials-economic impacts
N78-18550
International transfer of marine technology, a three-volume study — social, political and economic factors
[PB-275353/1] N78-18986

EDDY CURRENTS
Testing of turbulence models by exact numerical solution of the Navier-Stokes equations
[AD-A048199] N78-18365

EDEMA
Effect of prolonged hypokinesia on the course of acute aseptic inflammation
N78-18747

EDUCATION
The LARSYS educational package: Instructor's notes for use with the Data 100
[NASA-CR-151636] N78-18493
Compendium of training facilities in environmental problems related to meteorology and operational hydrology
[WMO-489] N78-18644
Compendium of meteorological training facilities, fifth edition
[WMO-240] N78-18649
Compendium of meteorology. Volume 2, part 1: General hydrology
[WMO-364] N78-18650
The independent learning project: A study of changing attitudes in American public libraries
[BLL-BLRDR-5396-[2113.56F]] N78-18984

EFFECTIVENESS
Towards a framework of organizational effectiveness
[AD-A047966L] N78-18969

EFFICIENCY
Notes on design of high efficiency beam dividers for two beam infra-red interferometers
[NPL-QU-41] N78-18406
Air transportation energy efficiency
N78-18540
The energy efficiency of urban transit systems
N78-18541

EFFUSIVES
Fundamental investigations on effusion cooling of turbine blades
[DLR-FB-77-39] N78-18074

EIGENVALUES
CAVE3: A general transient heat transfer computer code utilizing eigenvectors and eigenvalues
[NASA-CR-145290] N78-18359
Hybrid structures of revolution
[AD-A047982] N78-18461
Eigenvalue/eigenvector assignment using output feedback
[NASA-TP-1118] N78-18823
Numerical experiments concerning the eigenvalues of the Laplacian on a Zoll surface
N78-18836
Perturbation bounds for the definite generalized eigenvalue problem
[AD-A048072] N78-18841

EIGENVECTORS
CAVE3: A general transient heat transfer computer code utilizing eigenvectors and eigenvalues
[NASA-CR-145290] N78-18359
Eigenvalue/eigenvector assignment using output feedback
[NASA-TP-1118] N78-18823

EJECTION
Cartridge firing device designed for attachment, release and ejection of a satellite
N78-19033

ELASTIC BODIES
Improvement of modal methods for dynamic response problems of linear elastic structures
[DLR-FB-77-33] N78-18474

ELASTIC DEFORMATION
Finite deformation, elastic-plastic, finite element analysis of planar cracks
N78-18447

ELASTIC MEDIA
Theory of disclinations in elastic Cosserat media
N78-18234

ELASTIC PROPERTIES
Archives of Mechanics, volume 29, issue 5
N78-18240
Quasi-perfect elasticity. 1: Theoretical foundations
N78-18243
Preliminary experiment on acoustoelasticity for stress analysis
N78-18244
The application of invariant imbedding to problems in elastic stability
N78-18453

ELASTODYNAMICS
A theory for longitudinal wave propagation in a composite rod: A model for linear elastodynamic behavior of composite penetrators
[AD-A048552] N78-18285

ELASTOHYDRODYNAMICS
Statistical model for asperity-contact time fraction in elastohydrodynamic lubrication
[NASA-TP-1130] N78-18429

ELASTOMERS
Effect of hydraulic fluid [MIL-H-83282] on selected commercial O-ring compounds
[NASA-TM-78154] N78-18213
Phosphonitrilic fluoroelastomer fuel hose. Utilization of extruded tubes
[AD-A047960] N78-18432

ELASTOMETERS
Stiffness and damping of elastomeric O-ring bearing mounts
[NASA-CR-135328] N78-18460

ELASTOPLASTICITY
Elastic-plastic analysis of a rolling disk by finite elements
N78-18455

ELECTRIC AUTOMOBILES
State-of-the-art assessment of electric vehicles and hybrid vehicles
[NASA-TM-73756] N78-18988

ELECTRIC BATTERIES
Electric car technology for demonstration and development
N78-18551
Urban applications and energy impacts of future electric cars
N78-18552
Solid electrolyte battery materials
[AD-A048330] N78-18559

ELECTRIC CURRENT
Modeling of high current injection into bipolar semiconductors
[AD-A048781] N78-18330
Analysis of leak currents in field effect transistors with a submicron Schottky gate
[LCR-450/258] N78-18343

ELECTRIC DISCHARGES
The treatment of cellulose by high pressure discharge r-- molecular structure modifications
N78-18221

ELECTRIC FIELDS
Aircraft response effect on E-field measurements
[AD-A047986] N78-18272
The characteristics of broadband, isotropic electrical field and magnetic field probes
[PB-274457/1] N78-18339
Parameter studies relative to an electric field-induced dipole moment laser
[AD-A048327] N78-18417

ELECTRIC MOTOR VEHICLES
Electric car technology for demonstration and development
N78-18551
Urban applications and energy impacts of future electric cars
N78-18552

ELECTRIC POTENTIAL
Partial discharges in the transformers due to induced voltages
[NASA-TM-75256] N78-18310
Computer technique for calculations of potential distribution in multidielectric media
[AD-A048057] N78-18323

ELECTRIC POWER SUPPLIES
Semiconductor measurement technology: A versatile high-voltage bias supply for extended range MIS C[V] and G[V] measurements
[PB-274939/8] N78-18345
Electrification of railroads problems-potentials-economic impacts
N78-18550

ELECTRIC PULSES
A new model of nerve action potential and the existence of a pulse solution
N78-18676

ELECTRIC WIRE
Calculation of the per-unit length capacitance matrix for shielded insulated wires
[AD-A048174] N78-18324

ELECTRICAL PROPERTIES
Small-signal characteristics of gallium arsenide Schottky-Read IMPATT diodes
N78-18300
Theory of bound states associated with n-type inversion layers on silicon
[AD-A048216] N78-18960

ELECTRICAL RESISTIVITY
Pacemaker related conductance changes in cardiac Purkinje fibers
N78-18697
Thermal and electrical transport measurements in single crystal beryllium at low temperatures
N78-18952

ELECTRO-OPTICS
An electro optical MTI system for the detection of artificial satellites [the NITH finder]
[AD-A048055] N78-18099
Electrooptic phenomena and devices in gases
[AD-A048328] N78-18910
Common module electro optical multiplexer developer
[AD-A048484] N78-18914

ELECTROCHEMISTRY
A study for hypergolic vapor sensor development
[NASA-CR-155770] N78-18224

ELECTRODEPOSITION
Titanium diboride electrodeposited coatings
[AD-A047956] N78-18214

ELECTRODES
Electron transfer at sensitized semiconductor electrodes — photochemical reactions
N78-18949

ELECTROKINETICS
Comparison tests on the 100-GPM electrokinetic fuel decontaminator and a 100-GPM military standard filter/separator
[AD-A048655] N78-18226

ELECTROLYTES
Solid electrolyte battery materials
[AD-A048330] N78-18559
Electrolyte content of blood and potassium ion transport in erythrocytes of animals exposed to a steady magnetic field
N78-18727

ELECTROLYTIC CELLS
A study of the effect of velocity on corrosion of galvanic couples in seawater using a circling-foil apparatus
[AD-A048065] N78-18186
The effects of velocity on corrosion of galvanic couples in seawater
[AD-A048669] N78-18191

ELECTROMAGNETIC ABSORPTION
A plant canopy light absorption model with application to wheat
[NASA-CR-155778] N78-18500
Two-photon absorption of molecular crystals and gas — napthalene, biphenyl, and benzene
N78-18950

ELECTROMAGNETIC FIELDS
Aircraft response effect on E-field measurements
[AD-A047986] N78-18272
Near-field antenna measurements on a cylindrical surface: A source scattering-Matrix formulation
[PB-274938/0] N78-18287

ELECTROMAGNETIC INTERFERENCE
A theoretical investigation of spread spectrum modulation concepts and performance
N78-18258

ELECTROMAGNETIC PULSES
Processing EMP-related flash X-ray test data with the TRANS2 computer program
[AD-A048159] N78-18276
Measurement of the impulse response of communication antennas
[AD-A048070] N78-18288

ELECTROMAGNETIC RADIATION
Coupling of electromagnetic waves and space charge waves in type O traveling wave tubes
[NASA-TM-75249] N78-18309
Biological effects of nonionizing electromagnetic radiation Volume 2: Number 2, December 1977
[AD-A047647] N78-18705
RF dielectric properties measurement system: Human and animal data
[PB-274776/4] N78-18711
RF cell culture irradiation system with controlled temperature and field strength
[PB-274793/9] N78-18712

ELECTROMAGNETIC SCATTERING
Interaction of electromagnetic and acoustic waves in a stochastic atmosphere
[NASA-CR-155746] N78-18275
The integral equation method - a computational method for diffracted and scattered fields of complicated structures — satellite and aircraft antennas
N78-18291

ELECTROMECHANICAL DEVICES
State variable approach to the general theory of electrical machines
N78-18301

ELECTROMIGRATION
Electromigration of hydrogen and deuterium in vanadium, niobium and tantalum
N78-18177

ELECTROMYOGRAPHY
Dynamics of cyclic and acyclic locomotion of the Soyuz-18 crew after a 63-day space mission
N78-18740

ELECTRON ACCELERATORS
A simulation model for the FX-75 relativistic electron beam accelerator
N78-18895

ELECTRON ATTACHMENT
Attachment rates in rare gas halide lasers
[AD-A048764] N78-18420

ELECTRON BEAMS
Electron beam recorder applications study
[AD-A048666] N78-18399
IC fabrication using electron-beam technology
[AD-A048307] N78-18886
A simulation model for the FX-75 relativistic electron beam accelerator
N78-18895
Volume discharge in a gas, excited by an electron beam under conditions of nonuniform ionization
[NASA-TM-75231] N78-18927

ELECTRON DENSITY [CONCENTRATION]
Correlation distance of mean daytime electron content
[AD-A048117] N78-18608

ELECTRON DENSITY PROFILES
Electron number density measurement by ruby laser interferometry in a CO2 laser-induced gas breakdown plasma
[CONF-770725-1] N78-18938

ELECTRON DIFFRACTION
Low-energy electron diffraction from epitaxial solid krypton layers on graphite
N78-18946

ELECTRON EMISSION
Field electron and ion source research for high density information storage system
[AD-A048200] N78-18776

ELECTRON ENERGY
Comparative characteristics of electron energy spectrum in PIG and arc type discharge plasmas
[NASA-TM-75255] N78-18307
Energetic electrons at the synchronous altitude, 1974 - 1977
[NASA-CR-155775] N78-19025

ELECTRON MICROSCOPES
Simulation of transmission electron micrographs for small dislocation loops
N78-18904

ELECTRON MICROSCOPY
The determination of crack propagation curves with the aid of electron microscopy
[NLR-TR-75165-U] N78-18475

ELECTRON MOBILITY
Theory of surface polaritons in n-InSb in the presence of a DC current and an external DC magnetic field
[AD-A048217] N78-18959

ELECTRON PLASMA
Diagnosis of a relativistic nonneutral plasma column based on the synchrotron radiation spectrum, theory and experiment
N78-18922

ELECTRON PROBES
Microwave simulation of laser plasma interactions
[UCRL-13752] N78-18423

ELECTRON SCATTERING
Electron scattering from vibrationally excited nitrogen
N78-18881

ELECTRON STATES
Theory of bound states associated with n-type inversion layers on silicon
[AD-A048216] N78-18960

ELECTRON TRANSFER
Computer simulation of InP transferred-electron devices designed for Ka-band operation
N78-18303
Electron transfer at sensitized semiconductor electrodes — photochemical reactions
N78-18949

ELECTRON TRANSITIONS
Exchange and relaxation effects in low-energy radiationless transitions
[NASA-TM-79383] N78-18882

ELECTRONIC EQUIPMENT
Guidelines for the selection and application of tantalum electrolytic capacitors in highly reliable equipment
[NASA-TM-X-64755-REV-A] N78-18311
EDP network analysis for electronics in nuclear radiation environment
[BMVG-FBWT-77-13] N78-18899

ELECTRONIC FILTERS
High Q selective filters using mechanical resonance of silicon beams
N78-18304
An RC active filter design handbook
[NASA-SP-5104] N78-18312

ELECTRONIC MODULES
Standard electronic module radar cost analysis
[AD-A048207] N78-18319
Modular packaging approaches
[AD-A048205] N78-18321

ELECTRONIC PACKAGING
Modular packaging approaches
[AD-A048205] N78-18321

ELECTRONS
Radiation effects on A1GaAs/GaAs solar cells using 0.9-3.0 MeV protons and 1.0-1.4 MeV electrons
[AD-A048037] N78-18557

ELECTROSTATIC WAVES
Non-stochastic heating of magnetized plasma by electrostatic wave
[IPPJ-314] N78-18930
A perturbation expansion for the nonlinear Schrodinger equation with application to the influence of nonlinear Landau damping
[IPPJ-315] N78-18931
Modulated langmuir waves and nonlinear Landau damping — Schroedinger equation
[IPPJ-319] N78-18935

ELEVATORS [CONTROL SURFACES]
Calculation of the horizontal tail loads from elevator actuation
[DLR-IB-536-76/4] N78-18011

ELEVATORS [LIFTS]
A space necklace about the earth
[NASA-TM-75174] N78-18089

ELLIPTICITY
Ellipticity of 0.4 to 2.4 Hertz Rayleigh waves with application to the study of near surface earth structure
N78-18600

EMERGENCIES
Emergency space-suit helmet
[NASA-CASE-MSC-10954-1] N78-18761

EMISSION
Comparative characteristics of electron energy spectrum in PIG and arc type discharge plasmas
[NASA-TM-75255] N78-18307
Effect of preconditioning on in-use vehicle testing and failure analysis of evaporative emission control systems
[PB-274902/6] N78-18580
Aircraft emission factors
[PB-275067/7] N78-18595

EMISSION SPECTRA
Double optical resonance — quantum electrodynamics and emission spectra from atomic excitations
N78-18901

ENERGY ABSORPTION
Non-stochastic heating of magnetized plasma by electrostatic wave
[IPPJ-314] N78-18930

ENERGY CONSERVATION
Effects of Energy Constraints on Transportation Systems
N78-18529
The United States energy scene 1976-1985
N78-18530
Long range transportation planning under energy constraints: A critical review of current capability
N78-18532

Alternative automotive engines and energy conservation N78-18534
Energy and economic impacts of projected freight transportation improvements N78-18537
Trucking and fuel economy N78-18538
Estimated highway fuel savings in 1975 N78-18539
Air transportation energy efficiency N78-18540
President Carter's automobile related energy conservation proposals N78-18542
Federal policy options to effect fuel conservation in the air industry N78-18548
Estimating the energy conservation potential of ventilation control through weather data analysis [PB-273949/8] N78-18655

ENERGY CONSUMPTION
The energy efficiency of urban transit systems N78-18541

ENERGY CONVERSION EFFICIENCY
A computer analysis of heterojunction and graded bandgap solar cells N78-18512
Indoor thermal performance evaluation of Daystar solar collector [NASA-CR-150511] N78-18521
Solafern solar system design brochure [NASA-CR-150515] N78-18526

ENERGY DISSIPATION
Coupling of dissipative mechanisms of viscoplastic flow N78-18238

ENERGY POLICY
Thermal energy storage [NASA-CR-150563] N78-18520
Site dependent factors affecting the economic feasibility of solar powered absorption cooling [NASA-CR-150533] N78-18524
Analysis of requirements for accelerating the development of geothermal energy resources in California [NASA-CR-155782] N78-18528
Potential for automotive fuel economy improvement N78-18543
Outline of the energy-related projects sponsored by the Federal Railroad Administration, DOT N78-18544
Measurement and simulation of fuel consumption in rail freight service N78-18545
Intercity rail energy intensity for passenger movement N78-18546
A study of the energy consequences of alternative transport policies in intercity freight markets N78-18547
Federal policy options to effect fuel conservation in the air industry N78-18548
Measuring the impact on scheduled air lines operations of restrictions in fuel availability N78-18549
Electrification of railroads problems-potentials-economic impacts N78-18550
Electric car technology for demonstration and development N78-18551
Urban applications and energy impacts of future electric cars N78-18552
ERDA funding in transportation energy conservation area and research plans N78-18553
Data needs in transportation energy conservation research N78-18554
Energy intensity of various transportation modes N78-18555
Theory of wind turbines with contrarotation [UTIAS-218] N78-18556
Other storage reserve report [PB-273474/7] N78-18564
State solar energy legislation of 1976: A review of statutes relating to buildings [PB-273899/5] N78-18567
Estimating the energy conservation potential of ventilation control through weather data analysis [PB-273949/8] N78-18655
State-of-the-art assessment of electric vehicles and hybrid vehicles [NASA-TM-73756] N78-18988

ENERGY STORAGE
Thermal energy storage [NASA-CR-150563] N78-18520
Other storage reserve report [PB-273474/7] N78-18564
Magnetic bearing momentum wheels with magnetic gimballing capability for 3-axis active attitude control and energy storage N78-19031

ENERGY TECHNOLOGY
SIMS prototype system 1 test results: Engineering analysis [NASA-CR-150522] N78-18527

ENERGY TRANSFER
Formal and computational studies of molecular collision dynamics N78-18880
Relaxation of the bending mode of carbon dioxide by vibration to rotation and vibration to vibration energy transfer N78-18951

ENGINE DESIGN
F-15/nonaxisymmetric nozzle system integration study support program [NASA-CR-135252] N78-18070
Tripropellant engine study [NASA-CR-150562] N78-18119
State-of-the-art assessment of electric vehicles and hybrid vehicles [NASA-TM-73756] N78-18988

ENGINE NOISE
GE core engine noise investigation, low emission engines [AD-A048590] N78-18069
Experimental determination and comparison with theory of thrust, noise and driving weight of propeller drives — light aircraft Sportavia S5 [BMVG-FBWT-77-16] N78-18072

ENGINE PARTS
Studies of heat transfer to gas turbine components [AD-A048551] N78-18071

ENTRAINMENT
Deflected heated water jets, theory and experiments N78-18354

ENVIRONMENT EFFECTS
Radiological quality of the environment in the United States, 1977 [PB-274229/4] N78-18710
Carbon monoxide [PB-274965/3] N78-18713

ENVIRONMENT POLLUTION
Multimedium management of municipal sludge, volume 9 [PB-274093/4] N78-18998

ENVIRONMENT PROTECTION
SESAME/Environmental Research Laboratories [NASA-CR-150551] N78-18628
Compendium of training facilities in environmental problems related to meteorology and operational hydrology [WMO-489] N78-18644

ENVIRONMENT SIMULATION
Thermal performance of MSFC hot air collectors under natural and simulated conditions [NASA-CR-150506] N78-18525

ENVIRONMENTAL LABORATORIES
NOAA/National Hurricane and Experimental Meteorological Laboratory [NASA-CR-150550] N78-18627
SESAME/Environmental Research Laboratories [NASA-CR-150551] N78-18628

ENVIRONMENTAL MONITORING
Survey: National Environmental Satellite Service [NASA-CR-150546] N78-18098
Methods and standards for environmental measurement. Proceedings of the Materials Research Symposium [PB-275008/1] N78-18128
On the feasibility of monitoring soil moisture using active microwave remote sensing: An experimental evaluation N78-18477
Improved LANDSAT to give better view of earth resources [NASA-NEWS-RELEASE-78-22] N78-18480
Application of remote sensing data to surveys of the Alaskan environment [E78-10077] N78-18486

ENVIRONMENTAL SURVEYS
Advanced fossil fuel and the environment: An executive report [PB-274541/2] N78-18587
Environmental assessment of the Alaskan continental shelf. Northeast gulf of Alaska [PB-275212/9] N78-18619

ENVIRONMENTAL TESTS
Thermal performance of MSFC hot air collectors under natural and simulated conditions [NASA-CR-150506] N78-18525

ENVIRONMENTS
Characterization of current tower cab environments [AD-A048306] N78-18026

ENZYME ACTIVITY
Parameters of acid-base equilibrium and enzymatic activity of blood in man during brief antiorthostatic hypokinesia N78-18687
Lactate dehydrogenase isozymes of rat skeletal muscles following a space flight and with hypokinesia N78-18689

ENZYMES
Reaction kinetics and structure of enzyme macromolecules subjected to hydrodynamic shearing forces: Enzyme mechanochemistry N78-18210

EPITAXY
Low-energy electron diffraction from epitaxial solid krypton layers on graphite N78-18946
Magnetic LPE crystalline films for small bubble diameter cylindrical-domain memory applications [AD-A048197] N78-18957
Epitaxial growth of semi-insulating GaAs [AD-A048466] N78-18961

EPOXY RESINS
Biaxial testing of graphite/epoxy composites containing stress concentrations, part 2 [AD-A048659] N78-18140
Effect of temperature and cross-linkings on the flow behavior of a rubberized epoxy resin [UCRL-13732] N78-18220

EQUATIONS OF MOTION
The closed form solution of true proportional navigation [AD-A048008] N78-18031
Aeromechanical stability of helicopters with a bearingless main rotor. Part 1: Equations of motion [NASA-TM-78459] N78-18043
Finite element solution to equations for turbulent motion and diffusion in planetary boundary layer N78-18605

EQUATIONS OF STATE
State variable approach to the general theory of electrical machines N78-18301

EQUIPMENT SPECIFICATIONS
The 0.1m subsonic cryogenic tunnel at the University of Southampton [NASA-CR-145305] N78-18086

EREP
Earth Resources: A continuing bibliography with indexes, issue 15, October 1977 [NASA-SP-7041[15]] N78-18481

EROSION
LANDSAT application of remote sensing to shoreline-form analysis — Cape Hatteras, Cape Lookout, and Assateague Island [E78-10079] N78-18488
Hydraulic sensor instrumentation of a shore face in a tidal current convergence zone: Cape Henry, Virginia [PB-275247/5] N78-18671

ERROR CORRECTING CODES
Characterization and design of error correcting/detecting codes for asymmetric memories N78-18772
Bounds and techniques for linear source coding N78-18773

ERROR DETECTION CODES
Characterization and design of error correcting/detecting codes for asymmetric memories N78-18772

ERRORS
C-band radar pulse Doppler error: Its discovery, modeling, and elimination [NASA-TM-69366] N78-18265
Hardware verification [AD-A048684] N78-18778

ERYTHROCYTES
Electrolyte content of blood and potassium ion transport in erythrocytes of animals exposed to a steady magnetic field N78-18727

ESTIMATING
Regression estimation for multivariate normal distributions N78-18830

ESTUARIES
Evaluation of circulation in partially stratified estuaries as typified by the Hudson River N78-18476
Non-linearly induced residual currents in tidally dominated estuaries N78-18660

ETCHING
Industrial ion source technology — for ion beam etching, surface texturing, and deposition [NASA-CR-135353] N78-18883
Chemically polished quartz — using ammonium bifluoride [AD-A048077] N78-18958

EUCLIDEAN GEOMETRY
Forces in material Space N78-18246

EUROPE
Quick-look capability in a European earth resources satellite data network. Volume 2: Appendices 5 to 7 [FU15-4-VOL-2-APP-5-7] N78-18505
The occurrence of photochemical smog formation in western Europe [IG-PUBL-597] N78-18583

EUROPEAN SPACE PROGRAMS
Index of ELDO publications [ESA-SP-1006] N78-18102

EUTECTIC ALLOYS
Directionally solidified eutectic gamma-gamma nickel-base superalloys
[NASA-CASE-LEW-12905-1] N78-18183
EVALUATION
A comparative evaluation of searching by controlled language and natural language in an experimental NASA data base
[ESA-CR[P]-1009] N78-18979
EVAPORATION
Analytic solution for the equilibrium composition of a carbon-nitrogen-oxygen gas mixture
[AD-A048597] N78-18161
Effect of preconditioning on in-use vehicle testing and failure analysis of evaporative emission control systems
[PB-274902/6] N78-18580
EXCITATION
Exciter force apportioning for modal vibration testing using incomplete excitation
N78-18456
EXCRETION
Effect of gamma radiation on intensity of ammonia excretion in albino rats
N78-18735
EXHAUST GASES
Emission formation in heterogeneous combustion
[PB-274599/0] N78-18163
Performance characteristics of automotive engines in the United States. Report no. 10: Chevrolet [1975] 250 CID 1-bbl engine
[PB-274376/3] N78-18439
Shift schedules for emissions and fuel economy testing
[PB-274865/5] N78-18594
Vehicle exhaust emission instruments evaluation
[PB-274547/9] N78-18597
The relation of oxidant levels to precursor emissions and meteorological features. Volume 1: Analysis and findings
[PB-275001/6] N78-18618
Equations for approximating the thermodynamic data of a hydrogen/oxygen steam generator — exhaust gas temperature and characteristic velocity
[DLR-IB-456-77/9] N78-18964
EXHAUST SYSTEMS
Theory and methods for modelling acoustically long, unpartitioned cavity resonators for engine exhaust systems
N78-18427
EXOBIOLOGY
Aerospace Medicine and Biology: A continuing bibliography with indexes, supplement 175
[NASA-SP-7011[175]] N78-18677
Main stages and prospects of development of space biology and medicine
N78-18680
Experimental and general theoretical research
N78-18717
Space Biology and Aerospace Medicine, no. 4, 1977
[JPRS-69964] N78-18738
EXPLOSIVES
DOT behavior of waxed mixtures pf RDX, HMX, and tetryl
[AD-A047968L] N78-18225
Penetration of high explosives by inert projectiles — computerized simulation
[AD-A048326] N78-18227
EXPOSURE
Patient doses resulting from an X-ray recording [belly survey picture]. Influence of technical parameters on the dosage
[IRI-190-77-01] N78-18709
Effects of chronic exposure to carbon monoxide on biochemistry of human blood
N78-18748
Organism reactions to hypoxia following exposure to gamma radiation
N78-18750
EXTERNAL STORES
Application and comparison of modal perturbation methods and modal correction procedures exemplified by a swept wing with two external stores
[DLR-FB-77-21] N78-18014
Unsteady pressure measurements on wing-store combinations in incompressible flow
[ESA-TT-426] N78-18018
The effects of external stores on the flutter of a non-uniform cantilever
[AD-A048360] N78-18078
EXTRAGALACTIC RADIO SOURCES
Search for correlated radio and optical events in long-term studies of extragalactic sources
N78-19018
EXTRAPOLATION
Inductive extrapolation: A system for program synthesis from exemplary data employing regular grammar inference and polynomial separation of machine states
N78-18789
EXTRATERRESTRIAL LIFE
The search for extraterrestrial intelligence [SETI]
[NASA-SP-419] N78-18771
EXTREMELY HIGH FREQUENCIES
Computer simulation of InP transferred-electron devices designed for Ka-band operation
N78-18303

F

F-4 AIRCRAFT
F-4E avionics update
[AD-A047949] N78-18061
F-14 AIRCRAFT
Flight qualification of titanium F-14A airframe components manufactured by Hot Isostatic Pressing [HIP]
[AD-A048485] N78-18055
F-15 AIRCRAFT
F-15/nonaxisymmetric nozzle system integration study support program
[NASA-CR-135252] N78-18070
F-100 AIRCRAFT
Application of Doppler weather radar to turbulence measurements which affect aircraft
[AD-A048603] N78-18641
F-111 AIRCRAFT
Flight-determined stability and control coefficients of the F-111A airplane
[NASA-TM-72851] N78-18075
FABRICATION
IC fabrication using electron-beam technology
[AD-A048307] N78-18886
High-speed fabrication of aspherical surfaces — for optical equipment
N78-18900
FAIL-SAFE SYSTEMS
WALSHSTORE: The application of burst processing to fail-soft storage systems using Walsh transforms
[AD-A047889] N78-18774
FAILURE
On a generalization of Freund's bivariate failure model
[AD-A048152] N78-18847
FAILURE ANALYSIS
Failure analysis of pressure vessels with defects
[OUEL-1209/77] N78-18472
Effect of preconditioning on in-use vehicle testing and failure analysis of evaporative emission control systems
[PB-274902/6] N78-18580
FAR INFRARED RADIATION
The 16 to 40 micron spectra of Jupiter and Venus — far infrared absorption of hydrogen and sulfuric acid
N78-19008
FATIGUE [MATERIALS]
Fatigue design of fighters: Guidelines for obtaining and maintaining adequate fatigue performance of tactical aircraft
[AGARD-AG-231] N78-18046
Fatigue design of fighters; guidelines for obtaining and maintaining adequate fatigue performance of tactical aircraft: General survey
N78-18047
The development of fatigue/crack growth analysis loading spectra
N78-18048
Estimating fatigue crack initiation and propagation lives in notched plates under variable loading histories
N78-18451
FATIGUE LIFE
Calculation methods for fatigue life and crack propagation
N78-18049
FATIGUE TESTS
Fatigue design of fighters; guidelines for obtaining and maintaining adequate fatigue performance of tactical aircraft: General survey
N78-18047
Tests on details and components
N78-18050
Current standards of fatigue test on strike aircraft
[AGARD-AR-92] N78-18051
Fatigue load monitoring
N78-18052
Influence of microstructure on fatigue crack propagation rate of aluminium alloys
[ESA-TT-418] N78-18203
FEEDBACK CONTROL
Study to develop gradiometer techniques
[AD-A048252] N78-18609
Compensator improvement for multivariable control systems
N78-18820
Eigenvalue/eigenvector assignment using output feedback
[NASA-TP-1118] N78-18823
FEET [ANATOMY]
Drop foot corrective device
[NASA-CASE-LAR-12259-1] N78-18762
FIBER OPTICS
A star scene simulator for test and evaluation of imaging systems used in point-source detection
[AD-A048201] N78-18095
Design study of a serial digital interface based on fiber optics
[ESA-CR[P]-1008] N78-18916
Applications of quantum electronics. Part 3: Holographic couplers for optical fibre bundles
[OUEL-1185/77-PT-3] N78-18919
FIBER STRENGTH
Applications of quantum electronics. Part 2: The metal coating of optical fibres
[OUEL-1184/77-PT-2] N78-18918
FIBERS
Equations of steady flow through slightly curved multifilament bundles
N78-18233
FIELD EFFECT TRANSISTORS
Analysis of leak currents in field effect transistors with a submicron Schottky gate
[LCR-450/258] N78-18343
FIELD EMISSION
Field electron and ion source research for high density information storage system
[AD-A048200] N78-18776
FIELD STRENGTH
Diffusion in dislocation fields
N78-18248
FIELD THEORY [ALGEBRA]
Calculations of stresses in wall ironing
[OUEL-1187/77] N78-18469
Plane-strain general yielding of a pressurised cylindrical shell containing a long part-through notch
[OUEL-1199/77] N78-18470
The plane-strain general yielding of notched members due to combined axial force and bending. Volume 1: Wedge-shaped notches with large flank angles
[OUEL-1206/77-VOL-1] N78-18471
The plane-strain general yielding of notched members due to combined axial force and bending. Volume 2: Deep circular notches
[OUEL-1210/77-VOL-2] N78-18473
FIELD THEORY [PHYSICS]
Field equations for micropolar current and a heat conducting magnetically-saturated solid
N78-18239
FIGHTER AIRCRAFT
Fatigue design of fighters: Guidelines for obtaining and maintaining adequate fatigue performance of tactical aircraft
[AGARD-AG-231] N78-18046
Fatigue design of fighters; guidelines for obtaining and maintaining adequate fatigue performance of tactical aircraft: General survey
N78-18047
The development of fatigue/crack growth analysis loading spectra
N78-18048
FILAMENT WINDING
Technological and experimental investigations of window frames in FRP winding press technology — glass and carbon reinforced plastics
[DLR-IB-152-77/10] N78-18254
FILMS
A neutron scattering study of monolayer nitrogen films
N78-18944
FINES
Apollo 14 coarse fines [4-10 mm] sample location and classification
[NASA-TM-79348] N78-19020
FINISHES
Accelerated laboratory corrosion test for materials and finishes used in naval aircraft
[AD-A048059] N78-18188
FINITE DIFFERENCE THEORY
Split-operator, finite difference solution for axisymmetric laminar jet diffusion flames
[SAND-77-8502] N78-18079
Computer technique for calculations of potential distribution in multidielectric media
[AD-A048057] N78-18323
Transient free-surface hydrodynamics — a finite difference scheme for a Lagrangian formulation of inviscid incompressible flow
[AD-A048749] N78-18368
A simple finite difference technique for the computation of three-dimensional incompressible laminar boundary layers. Part 1: Description of the method
[NLR-TR-76086-U] N78-18371
FINITE ELEMENT METHOD
Finite deformation, elastic-plastic, finite element analysis of planar cracks
N78-18447
Elastic-plastic analysis of a rolling disk by finite elements
N78-18455
Finite element capabilities in MIT Lincoln Laboratory version of STRUDL
[AD-A048605] N78-18466
Finite element solution to equations for turbulent motion and diffusion in planetary boundary layer
N78-18605
FIRE CONTROL
F-4E avionics update
[AD-A047949] N78-18061

An application of interactive computer graphics technology to the design of dispersal mechanisms
N78-19032
Cartridge firing device designed for attachment, release and ejection of a satellite
N78-19033
FIRES
Studies of the flash fire potential of aircraft cabin interior materials
[AD-A048475] N78-18158
FIXED WINGS
The analysis of National Transportation Safety Board large fixed-wing aircraft accident/incident reports for the potential presence of low-level wind shear
[AD-A048354] N78-18021
FLAME SPECTROSCOPY
Studies of atoms vaporized from individual solute particles in analytical flames
N78-18150
FLAMES
Split-operator, finite difference solution for axisymmetric laminar jet diffusion flames
[SAND-77-8502] N78-18079
Chemical laser potential of selected group 4-A metal oxides
[AD-A048779] N78-18419
FLAMMABILITY
Studies of the flash fire potential of aircraft cabin interior materials
[AD-A048475] N78-18158
Flammability assessment tests for organic materials: The oxygen index/temperature index concept
[AD-A047830] N78-18159
FLAPPING
Application of system identification to analytic rotor modeling from simulated and wind tunnel dynamic test data
N78-18040
FLASH POINT
Studies of the flash fire potential of aircraft cabin interior materials
[AD-A048475] N78-18158
FLAT PLATES
Two-dimensional transonic testing with splitter plates
[NASA-TP-1153] N78-17999
Theoretical investigation of the viscid flow around a flat plate with ground effect
[DLR-FB-77-35] N78-18016
Nonlinear dynamic analysis of flat plate layered bodies accounting for large transverse deflections
N78-18452
FLAT SURFACES
Totally and partially ambiguous points of planar functions
N78-18834
FLEXING
Flexnozzle steering of a fluid jet
[FFA-MEMO-114] N78-18372
FLIGHT CLOTHING
A personal cooling system for helicopter pilots
[AD-A047649] N78-18767
FLIGHT CONTROL
Flight test results of the strapdown hexad inertial reference unit [SIRU]. Volume 2: Test report
[NASA-TM-73223] N78-18025
Flight-determined stability and control coefficients of the F-111A airplane
[NASA-TM-72851] N78-18075
FLIGHT HAZARDS
Engineering and development program plan: Wind shear
[AD-A048352] N78-18629
FLIGHT OPTIMIZATION
Optimal level controls of high performance aircraft
[DLR-IB-552-77/20] N78-18059
FLIGHT PATHS
Flight-path reconstruction of symmetric nonsteady flights
[NLR-TR-76133-U] N78-18056
FLIGHT SIMULATORS
Optimal aircraft simulator development by adaptive random search optimization
N78-18082
Full color hybrid display for aircraft simulators — landing aids
[NASA-CASE-ARC-10903-1] N78-18083
Automated weapon system trainer: Expanded adaptive module for basic instrument flight maneuvers
[AD-A048498] N78-18087
FLIGHT STABILITY TESTS
Flight-determined stability and control coefficients of the F-111A airplane
[NASA-TM-72851] N78-18075
Flight test of stick force stability in attitude-stabilized aircraft
[NLR-MP-77015-U] N78-18080
Determination of dynamic characteristics from flight test data
[ESA-TT-434] N78-18081
FLIGHT STRESS [BIOLOGY]
Heterophilic antibodies and complement activity of rat blood serum after flight in Kosmos-605 satellite
N78-18731
Assessing pilot workload
[AGARD-AG-233] N78-18770
FLIGHT TESTS
Flight test results of the strapdown hexad inertial reference unit [SIRU]. Volume 2: Test report
[NASA-TM-73223] N78-18025
Flight tests of a radio-controlled airplane mode with a free-wing, free-canard configuration
[NASA-TM-72853] N78-18042
A flight evaluation of a trailing anemometer for low-speed calibrations of airspeed systems on research aircraft
[NASA-TP-1135] N78-18044
Flight-path reconstruction of symmetric nonsteady flights
[NLR-TR-76133-U] N78-18056
Improvement of flight measuring data with a Kalman filter
[BMVG-FBWT-77-6] N78-18057
The philosophy adopted for the flight testing of the Panavia Tornado avionics system in Hack aircraft
N78-18060
Test and evaluation of the Moving Target Detector (MTD) radar
[AD-A047788] N78-18260
Determination of antenna radiation patterns, radar cross sections and jam-to-signal ratios by flight tests
[NLR-MP-76023-U] N78-18289
FLIGHT TRAINING
Automated weapon system trainer: Expanded adaptive module for basic instrument flight maneuvers
[AD-A048498] N78-18087
FLIR DETECTORS
Common module electro optical multiplexer developer
[AD-A048484] N78-18914
FLORIDA
Saline-water intrusion in the Fernandina Beach area, Nassau County, Florida
[PB-274015/7] N78-18504
FLOW CHARACTERISTICS
Effect of temperature and cross-linkings on the flow behavior of a rubberized epoxy resin
[UCRL-13732] N78-18220
The existence of instationary flows in incompressible micropolar fluids
N78-18249
Structure of turbulence in complex flows — shear layers
N78-18385
FLOW DEFLECTION
Flexnozzle steering of a fluid jet
[FFA-MEMO-114] N78-18372
FLOW DISTORTION
Effects of vertical distortion on thermalhydraulic modeling of surface discharges
N78-18479
FLOW DISTRIBUTION
Inviscid, nonadiabatic flow fields over blunt, sonic corner bodies for outer planet entry conditions by a method of integral relations
[NASA-TP-1133] N78-18363
Status and future prospects of using numerical methods to study complex flows at high Reynolds numbers
N78-18388
FLOW EQUATIONS
Equations of steady flow through slightly curved multifilament bundles
N78-18233
FLOW MEASUREMENT
Applications of non-intrusive instrumentation in fluid flow research
[AGARD-AR-112] N78-18374
FLOW STABILITY
Introduction to unsteady aspects of separation in subsonic and transonic flow
N78-18381
FLOW VELOCITY
On the prediction of mass flow rates of propane
N78-18350
Equations for approximating the thermodynamic data of a hydrogen/oxygen steam generator — exhaust gas temperature and characteristic velocity
[DLR-IB-456-77/9] N78-18964
FLOW VISUALIZATION
Prediction of unsteady separated flows on oscillating airfoils
N78-18387
FLOWMETERS
A computer code for the simulation of turbulent swirling flow through closed-conduit flow meters
[PB-274650/1] N78-18370
FLUID DYNAMICS
Filtering of non-linear instabilities
[NASA-CR-155779] N78-17996
Three Dimensional and Unsteady Separation at High Reynolds Numbers
[AGARD-LS-94] N78-18375
FLUID FILTERS
Comparison tests on the 100-GPM electrokinetic fuel decontaminator and a 100-GPM military standard filter/separator
[AD-A048655] N78-18226
FLUID FLOW
Applications of non-intrusive instrumentation in fluid flow research
[AGARD-AR-112] N78-18374
FLUID JETS
Flexnozzle steering of a fluid jet
[FFA-MEMO-114] N78-18372
FLUID MECHANICS
Applications of non-intrusive instrumentation in fluid flow research
[AGARD-AR-112] N78-18374
FLUORESCENCE
Video fluorometry: A novel approach to the acquisition and interpretation of multicomponent fluorescence data
N78-18142
Matrix isolation fluorescence spectroscopy of polycyclic aromatic hydrocarbons
N78-18147
Atomic fluorescence flame spectrometry with a continuous wave dye laser
N78-18409
FLUORIDES
Chemically polished quartz — using ammonium bifluoride
[AD-A048077] N78-18958
FLUORINE COMPOUNDS
Phosphonitrilic fluoroelastomer fuel hose. Utilization of extruded tubes
[AD-A047960] N78-18432
FLUOROCARBONS
Synthesis and biological screening of novel hybrid fluorocarbon hydrocarbon compounds for use as artificial blood substitutes
[NASA-CR-155781] N78-18702
FLUTTER
The effects of external stores on the flutter of a non-uniform cantilever
[AD-A048360] N78-18078
FLUTTER ANALYSIS
Development and application of an optimization procedure for flutter suppression using the aerodynamic energy concept
[NASA-TP-1137] N78-18459
FLUX DENSITY
Hydrological application of atmospheric vapour-flux analyses
[WMO-476] N78-18652
FLYING PERSONNEL
Significance of the percussion symptom in detection of peptic ulcers in flight personnel
N78-18693
FLYING PLATFORMS
SEAP: A Spacelab experiments propulsive platform for the transport of Spacelab payloads. First study results
[DLR-IB-456-76/1] N78-18109
FLYWHEELS
Structural analysis and testing for composite flywheel development
[AD-A048076] N78-18137
Development of a satellite flywheel family operating on one active axis magnetic bearings
N78-19043
FOAMS
Spacecraft disinfectant/cleansing agent development
[NASA-CR-151628] N78-18212
FOCUSING
Intense focussed ion beams and their interaction with matter
[AD-A048753] N78-18887
Applications of quantum electronics. Part 3: Holographic couplers for optical fibre bundles
[OUEL-1185/77-PT-3] N78-18919
Scanning and focusing mechanisms of METEOSAT radiometer
N78-19028
FORCED CONVECTION
An examination of combined free and forced convection phenomena in a density-stratified fluid
N78-18353
FOREBODIES
Drag, flow transition, and laminar separation on nine bodies of revolution having different forebody shapes
[AD-A048274] N78-18001
FOREIGN POLICY
Selecting analytic approaches for decision situations Volume 2. Case studies — foreign policy and defense industries
[AD-A047880] N78-18967
FORESTS
Application of remote sensing data to surveys of the Alaskan environment
[E78-10077] N78-18486
Investigations using data from LANDSAT 2 — Bangladesh
[E78-10080] N78-18489
FORMAT
World Weather Watch. International global data-processing system plan to support the first GARP global experiment
[WMO-469] N78-18651

FORMING TECHNIQUES
Hot forming of silicon sheet, silicon sheet growth development for the large area silicon sheet task of the low cost silicon solar array project
[NASA-CR-155934] N78-18517
FORMULATIONS
On the non-standard formulation of mechanics N78-18237
FORTRAN
FORTRAN compiler validation
[AD-A048317] N78-18780
FORTRAN complier validation summary report
[AD-A048353] N78-18781
The diagnostic facilities in ALGOL and FORTRAN compilers
[NPL-NAC-81] N78-18786
FORTRAN program to determine length of gage blocks using single wavelength interferometry
[PB-274895/2] N78-18811
FORWARD SCATTERING
Frequency spreading in forward surface scattering
[AD-A048741] N78-18877
FOSSIL FUELS
Advanced fossil fuel and the environment: An executive report
[PB-274541/2] N78-18587
FOURIER TRANSFORMATION
Matrix isolation Fourier transform infrared spectroscopy of polycyclic aromatic hydrocarbons N78-18146
Infrared Fourier transform spectroscopy of chromatographically separated species N78-18151
Fourier transform infrared spectroscopy: Demonstration of measurement capabilities in the laboratory and the field
[RM-648] N78-18157
High sensitivity Fourier transform NMR. Intermolecular interactions between environmental toxic substances and biological macromolecules
[PB-274011/6] N78-18675
Quantization of image transforms with minimum distortion
[PB-274533/9] N78-18788
FRACTOGRAPHY
The determination of crack propagation curves with the aid of electron microscopy
[NLR-TR-75165-U] N78-18475
FRACTURE MECHANICS
Ductile fracture initiation in pure alpha-FE N78-18181
High strength aluminum casting technology: Squeeze casting of 7075 alloy
[AD-A048657] N78-18192
Plane-strain general yielding of a pressurised cylindrical shell containing a long part-through notch
[OUEL-1199/77] N78-18470
Time dependent fault mechanics and wave propagation in rocks N78-18603
FRACTURE STRENGTH
The effect of microstructure and strength on the fracture toughness of an 18 Ni, 300 grade maraging steel N78-18174
FRAMES
Experiments on dynamic plastic loading on frames
[AD-A048687] N78-18464
FREE CONVECTION
An examination of combined free and forced convection phenomena in a density-stratified fluid N78-18353
FREEZING
A multi-purpose cryostat for freezing biological materials
[OUEL-1195/77] N78-18255
Design of a blood-freezing system for leukemia research
[NASA-TP-1165] N78-18673
FREIGHT COSTS
A study of the energy consequences of alternative transport policies in intercity freight markets N78-18547
Energy intensity of various transportation modes N78-18555
FREQUENCY ASSIGNMENT
Interference to audio devices and receivers from signals near 27, 220 and 900 MHz
[PB-274887/9] N78-18879
FREQUENCY CONTROL
A digital frequency-offset lock system designed for use with stabilized lasers
[NPL-QU-40] N78-18424
FREQUENCY MODULATION
A production engineering measure for two L-band solid state microwave frequency sources
[AD-A047903] N78-18315
FREQUENCY RESPONSE
Computer aided analysis of microwave electronic circuits in the frequency domain [ESAMEC]
[ESA-TT-441] N78-18341
FREQUENCY SHIFT
Frequency spreading in forward surface scattering
[AD-A048741] N78-18877
FREQUENCY STABILITY
A digital frequency-offset lock system designed for use with stabilized lasers
[NPL-QU-40] N78-18424
FREQUENCY SYNTHESIZERS
Building block modules: Frequency synthesizer and amplifier-mixer
[AD-A048209] N78-18320
FRICTION
Neutron star crust-neutron superfluid frictional forces N78-19010
FUEL CONSUMPTION
Performance characteristics of automotive engines in the United States. Report no. 8: Mitsubishi Model 6D57 diesel engine
[PB-274374/8] N78-18437
Performance characteristics of automotive engines in the United States. Report no. 9: Chrysler [1975] 225-CID 1-bbl engine
[PB-274375/5] N78-18438
Performance characteristics of automotive engines in the United States. Report no. 10: Chevrolet [1975] 250 CID 1-bbl engine
[PB-274376/3] N78-18439
Performance characteristics of automotive engines in the United States. Report no. 11: Chrysler [1975] 318-CID 2-bbl engine
[PB-274377/1] N78-18440
Energy consumption in the transportation sector N78-18531
Optimization of the vehicle-fuel-refinery system N78-18533
Trucking and fuel economy N78-18538
Estimated highway fuel savings in 1975 N78-18539
Potential for automotive fuel economy improvement N78-18543
Measurement and simulation of fuel consumption in rail freight service N78-18545
Federal policy options to effect fuel conservation in the air industry N78-18548
Measuring the impact on scheduled air lines operations of restrictions in fuel availability N78-18549
Energy intensity of various transportation modes N78-18555
Shift schedules for emissions and fuel economy testing
[PB-274865/5] N78-18594
FUEL INJECTION
Phosphonitrilic fluoroelastomer fuel hose. Utilization of extruded tubes
[AD-A047960] N78-18432
FUNCTION SPACE
Fake quaternionic projective spaces from a homotopy point of view N78-18869
FUNCTIONAL ANALYSIS
The helmet protects the aviator's head - or does it
[AD-A048574] N78-18766
Periodic optimization and controllability of periodic control systems N78-18821
FUNCTIONS (MATHEMATICS)
Totally and partially ambiguous points of planar functions N78-18834
Ten-place tables of the Voigt and growth functions
[AD-A047871] N78-18840
FUSELAGES
A procedure for the determination of the effect of fuselage nose bluntness on the wave drag of supersonic cruise aircraft
[NASA-CR-145306] N78-17994
Fuselage structure using advanced technology metal matrix fiber reinforced composites
[NASA-CASE-LAR-11688-1] N78-18045
FUSES (ORDNANCE)
Cost and reliability aspects of large CMOS integrated circuits for fuzing applications
[AD-A048276] N78-18329

G

GALACTIC CLUSTERS
Models for X-ray and radio emission from clusters of galaxies N78-19006
GALACTIC STRUCTURE
Photometric study of the structure of lenticular galaxies N78-19009
GALAXIES
Photometric study of the structure of lenticular galaxies N78-19009
GALLIUM ARSENIDE LASERS
Effects of gamma radiation on gallium-arsenide lasers
[AD-A048361] N78-18418
GALLIUM ARSENIDES
Small-signal characteristics of gallium arsenide Schottky-Read IMPATT diodes N78-18300
Manufacturing methods and technology engineering high-efficiency, high-power gallium arsenide read-type IMPATT diodes, volume 2
[AD-A048579] N78-18334
Manufacturing methods and technology engineering high-efficiency, high-power gallium arsenide read-type IMPATT diodes, volume 1
[AD-A048578] N78-18335
Radiation effects on A1GaAs/GaAs solar cells using 0.9-3.0 MeV protons and 1.0-1.4 MeV electrons
[AD-A048037] N78-18557
Epitaxial growth of semi-insulating GaAs
[AD-A048466] N78-18961
GALVANOMAGNETIC EFFECTS
Theory of the galvanomagnetic properties of inhomogeneous metals: Application to copper N78-18184
GAMMA RAYS
Effects of gamma radiation on gallium-arsenide lasers
[AD-A048361] N78-18418
Effect of gamma radiation on intensity of ammonia excretion in albino rats N78-18735
Organism reactions to hypoxia following exposure to gamma radiation N78-18750
GAS ANALYSIS
Methods and standards for environmental measurement. Proceedings of the Materials Research Symposium
[PB-275008/1] N78-18128
GAS CHROMATOGRAPHY
Infrared Fourier transform spectroscopy of chromatographically separated species N78-18151
GAS COOLING
Subsonic gas target 14 MeV neutron generator N78-18896
GAS DETECTORS
A sensor for the detection of CO2 in hyperbaric gaseous environments
[AD-A048599] N78-18400
Vehicle exhaust emission instruments evaluation
[PB-274547/9] N78-18597
GAS DISCHARGE TUBES
Investigation of the jet wake discharge flow of a heavily loaded centrifugal compressor impeller
[DLR-FB-77-32] N78-18073
GAS DYNAMICS
Electrooptic phenomena and devices in gases
[AD-A048328] N78-18910
GAS FLOW
Laser absorption phenomena in flowing gas devices
[NASA-CR-135129] N78-18411
GAS GENERATORS
Rocket gas generators - terrestrial use of space technology
[DLR-IB-456-76/9] N78-18121
GAS INJECTION
Studies of gas injection into a liquid stream
[OUEL-1216/77] N78-18373
GAS IONIZATION
Volume discharge in a gas, excited by an electron beam under conditions of nonuniform ionization
[NASA-TM-75231] N78-18927
GAS LASERS
Collision studies of gaseous molecular lasers
[AD-A048010] N78-18413
Attachment rates in rare gas halide lasers
[AD-A048764] N78-18420
GAS STREAMS
Variable mixer propulsion cycle
[NASA-CASE-LEW-12917-1] N78-18067
GAS TEMPERATURE
Equations for approximating the thermodynamic data of a hydrogen/oxygen steam generator — exhaust gas temperature and characteristic velocity
[DLR-IB-456-77/9] N78-18964
GAS TURBINE ENGINES
Integrated gas turbine engine-nacelle
[NASA-CASE-LEW-12389-2] N78-18066
Variable mixer propulsion cycle
[NASA-CASE-LEW-12917-1] N78-18067
Studies of heat transfer to gas turbine components
[AD-A048551] N78-18071
GAS TURBINES
Microstructure stability of high temperature cast and forged alloys on Ni basis — gas turbine materials N78-18201
GAS-LIQUID INTERACTIONS
Studies of gas injection into a liquid stream
[OUEL-1216/77] N78-18373
GAS-METAL INTERACTIONS
Gas surface interactions — recombination reactions with tungsten and platinum
[AD-A048667] N78-18160

GASES
Volume discharge in a gas, excited by an electron beam under conditions of nonuniform ionization
[NASA-TM-75231] N78-18927
GEODESY
The AFGL four color infrared sky survey: Supplemental catalog
[AD-A048048] N78-19014
GEODETIC COORDINATES
Systems for the determination of polar motion
[PB-274698/0] N78-18617
GEOIDS
Short arc reduction of radar altimetry computer program
[NASA-CR-141434] N78-18798
GEOLOGICAL FAULTS
Self-similar solutions of dislocation group dynamics and its application to aseismic faulting processes
N78-18448
GEOLOGY
Selection of a seventh spectral band for the LANDSAT-D thematic mapper
[E78-10078] N78-18487
The geology of the Great Lakes ice cover
N78-18601
GEOMAGNETISM
Geomagnetic data for March 1976 [AE [7] indices and stacked magnetograms]
[PB-275096/6] N78-18614
Geomagnetic data for February 1976 [AE [7] indices and stacked magnetograms
[PB-275095/8] N78-18615
Solar-geophysical data number 397, September 1977. Part 1: Data for August - July 1977
[PB-274823/4] N78-19023
Solar-Geophysical data number 397, September 1977. Part 2: Data for March - February 1977 and miscellanea
[PB-274824/2] N78-19024
GEOMETRY
Random coverage problems in geometrical probability with an application to time series analysis
N78-18857
Optical escape factors for Doppler profiles in spherical, cylindrical and plane parallel geometries
[IPPJ-317] N78-18933
GEORGIA
Cost benefit analysis of the transfer of NASA remote sensing technology to the state of Georgia
[E78-10076] N78-18485
GEOS SATELLITES [ESA]
The GEOS-20 m Cable Boom Mechanism
N78-19040
GEOS 3 SATELLITE
Deep sea tides determination from GEOS-3
[NASA-CR-141435] N78-18661
Short arc reduction of radar altimetry computer program
[NASA-CR-141434] N78-18798
GEOTHERMAL RESOURCES
Analysis of requirements for accelerating the development of geothermal energy resources in California
[NASA-CR-155782] N78-18528
GERT
Graphical evaluation of relativistic matrix elements
[NASA-CR-155774] N78-18884
GEYSERS
Heat flow in a geothermally active area: The Geysers, California
N78-18602
GHANA
Supporting investigations during testing of the WDL-1 airship in Ghana and Upper Volta — hull temperature, flight data, operational problems
[DLR-IB-536-77/1] N78-18012
GIMBALS
Magnetic bearing momentum wheels with magnetic gimballing capability for 3-axis active attitude control and energy storage
N78-19031
GLASS
Mechanisms and kinetics of binary alkali silicate glass corrosion
N78-18207
GLASS COATINGS
The chemical, mechanical, and implant properties of glass-coated alumina
N78-18130
GLASS FIBER REINFORCED PLASTICS
Experimental and theoretical stress analysis of a fiber reinforced plastic tensile specimen with a hole in it
[ESA-TT-417] N78-18223
GLASS FIBERS
Effect of drawing atmosphere on surface characteristics of glass fibers
N78-18208
Applications of quantum electronics. Part 2: The metal coating of optical fibres
[OUEL-1184/77-PT-2] N78-18918
GLOBAL ATMOSPHERIC RESEARCH PROGRAM
World Weather Watch. International global data-processing system plan to support the first GARP global experiment
[WMO-469] N78-18651
GLOBAL POSITIONING SYSTEM
Airworthiness evaluation NUH-1H helicopter with global positioning system
[AD-A047971] N78-18053
GLOW DISCHARGES
Aerodynamic stabilization of gaseous discharges
[AD-A048533] N78-18415
GOVERNMENT PROCUREMENT
Preliminary analysis of an option for the Federal photovoltaic utilization program
[PB-274220/3] N78-18562
GOVERNMENT/INDUSTRY RELATIONS
Federal policy options to effect fuel conservation in the air industry
N78-18548
GOVERNMENTS
Guidelines for the regional evaluation of state and local NSR [New Source Review] programs
[PB-275053/7] N78-18582
GRANULAR MATERIALS
Archives of mechanics, volume 29, issue 4
N78-18231
Model laws for granular media and powders with a special view to silo models
N78-18235
Mathematical elaboration of the double sliding, free rotating model
N78-18236
On relativistic dust grains and extensive air showers
[TRITA-EPP-77-17] N78-19017
GRAPH THEORY
An algorithm for testing the planarity of partially oriented graphs
[AD-A048052] N78-18314
On the planarity of hypergraphs
[AD-A048051] N78-18318
Synthesis of sequences for traffic signal controllers using techniques of the theory of graphs
[OUEL-1189/77] N78-18993
GRAPHITE
Biaxial testing of graphite/epoxy composites containing stress concentrations, part 2
[AD-A048659] N78-18140
Low-energy electron diffraction from epitaxial solid krypton layers on graphite
N78-18946
GRAPHITE-EPOXY COMPOSITE MATERIALS
Composite hub/metal blade compressor rotor
[NASA-CR-135343] N78-18131
GRAPHS [CHARTS]
An algorithm for testing the planarity of partially oriented graphs
[AD-A048052] N78-18314
Almost traceable graphs and traceability
N78-18832
A separator theorem for planar graphs
[AD-A048786] N78-18872
GRAVITATIONAL EFFECTS
Change in gravitation level as a stress factor
N78-18683
Certain peculiarities of the functioning of the cardiovascular system in bedrest conditions during horizontal and antiorthostatic body positions
[NASA-TM-75075] N78-18699
Low-speed impact phenomena and orbital resonances in the moon- and planet-building process
[NASA-CR-155310] N78-19016
GRAVITATIONAL FIELDS
Study to develop gradiometer techniques
[AD-A048252] N78-18609
Effect of head orientation in the gravity field on severity of caloric nystagmus
N78-18691
GREAT LAKES [NORTH AMERICA]
The geology of the Great Lakes ice cover
N78-18601
GREAT PLAINS CORRIDOR [NORTH AMERICA]
Spectral measurement of watershed coefficients in the southern Great Plains
[E78-10073] N78-18482
GROUND EFFECT [AERODYNAMICS]
Theoretical investigation of the viscid flow around a flat plate with ground effect
[DLR-FB-77-35] N78-18016
GROUND SUPPORT EQUIPMENT
Design and development of the Space Shuttle tail service masts
N78-19027
GROUND TRUTH
Investigations using data from LANDSAT 2 — Bangladesh
[E78-10080] N78-18489
GROUND WATER
Saline-water intrusion in the Fernandina Beach area, Nassau County, Florida
[PB-274015/7] N78-18504
Sanitary landfills: A bibliography, volume 2
[PB-274440/7] N78-19002
GROUP DYNAMICS
Self-similar solutions of dislocation group dynamics and its application to aseismic faulting processes
N78-18448
GROUP THEORY
Some problems concerning residual finiteness in algebras
N78-18837
Interplay between algebra and topology: Groupoids in a variety
N78-18866
Phase transitions and critical phenomena: Universality and global multicritical phase diagrams from position-space renormalization-group studies
N78-18945
GUIDANCE [MOTION]
The closed form solution of true proportional navigation
[AD-A048008] N78-18031
GUNNERY TRAINING
F-4E avionics update
[AD-A047949] N78-18061
GUST ALLEVIATORS
Analytical study of a free-wing/free-trimmer concept — for gust alleviation and high lift
[NASA-CR-2946] N78-18000
GUSTS
Development and application of an optimization procedure for flutter suppression using the aerodynamic energy concept
[NASA-TP-1137] N78-18459
GYROSCOPES
Micro navigator [MICRON] phase 2B. Volume 1: Technical report
[AD-A048000] N78-18030
Nondestructible MESG program
[AD-A048191] N78-18397

H

HALIDES
Attachment rates in rare gas halide lasers
[AD-A048764] N78-18420
HALLEY'S COMET
Ion Propulsion Module [IPM] technology readiness assessment: 1985 Halley's Comet rendezvous mission
[NASA-CR-155308] N78-18120
HANDBOOKS
Guidelines for the selection and application of tantalum electrolytic capacitors in highly reliable equipment
[NASA-TM-X-64755-REV-A] N78-18311
An RC active filter design handbook
[NASA-SP-5104] N78-18312
HARDENING [MATERIALS]
The relationship between the microstructure and age hardening response in the metastable beta titanium alloy Ti-11.5Mo6Zr-4.5Sn [beta 3]
[AD-A048773] N78-18196
Investigation of processing microstructures and properties of oxide dispersion strengthened cobalt alloy extruced shapes
[AD-A048593] N78-18198
HARMONIC ANALYSIS
PHAROS, processor for harmonic analysis of the response of oscillating surfaces — Wind tunnel models
[NLR-MP-77012-U] N78-18019
HAZARDS
The hazard ranking and allocation methodology: Assembly of the hazard ranking and allocation methodology: Assembly of the hazard estimation data base for air and surface water pollutants
[AD-A047826] N78-18575
HEAD [ANATOMY]
Effect of head orientation in the gravity field on severity of caloric nystagmus
N78-18691
HEAD-UP DISPLAYS
A comparison of integrated and conventional cockpit warning systems — pilot performance and reaction time in man machine systems
[AD-A048670] N78-18022
Holographic combiners for head-up displays
[AD-A047998] N78-18064
HEALTH
Carbon monoxide
[PB-274965/3] N78-18713
HEALTH PHYSICS
Radiological quality of the environment in the United States, 1977
[PB-274229/4] N78-18710
HEART
Pacemaker related conductance changes in cardiac Purkinje fibers
N78-18697
HEART RATE
Influence of central venous pressure upon sinus node responses to arterial baroreflex stimulation in man
[NASA-CR-155783] N78-18678
Sleep wakefulness determinations from heart rate data, volume 3
[AD-A045817] N78-18703
HEAT EXCHANGERS
System design package: Maxi-therm S-101 heating module, passive heat exchanger
[NASA-CR-150516] N78-18522
HEAT FLUX
Restrictions on heat conduction in simple materials
N78-18242

HEAT PIPES
Heat pipes and their use in technology
[NASA-TM-75148] N78-18357
HEAT RESISTANT ALLOYS
Directionally solidified eutectic gamma-gamma nickel-base superalloys
[NASA-CASE-LEW-12905-1] N78-18183
Microstructure stability of high temperature cast and forged alloys on Ni basis — gas turbine materials
N78-18201
HEAT STORAGE
Heat pipes and their use in technology
[NASA-TM-75148] N78-18357
Solar energy storage subsystem utilizing latent heat of phase change
N78-18513
Thermal energy storage
[NASA-CR-150563] N78-18520
HEAT TRANSFER
Studies of heat transfer to gas turbine components
[AD-A048551] N78-18071
CAVE3: A general transient heat transfer computer code utilizing eigenvectors and eigenvalues
[NASA-CR-145290] N78-18359
Solar energy storage subsystem utilizing latent heat of phase change
N78-18513
HEAT TRANSMISSION
Unconfined thermal discharges near free surfaces
N78-18351
Heat flow in a geothermally active area: The Geysers, California
N78-18602
HEAT TREATMENT
Existence of solutions for the prestressed non-linear orthotropic heated plates
N78-18247
HEATING
System design package: Maxi-therm S-101 heating module, passive heat exchanger
[NASA-CR-150516] N78-18522
HEATING EQUIPMENT
Installation package - SIMS prototype system 1A
[NASA-CR-150524] N78-18523
HEAVY IONS
Coupled-channel analysis for heavy-ion induced scattering and transfer reactions
N78-18894
HELICOPTER DESIGN
A new helicostat from SNIAS helicopter division
[NASA-TM-75063] N78-18041
HELICOPTER PERFORMANCE
A new helicostat from SNIAS helicopter division
[NASA-TM-75063] N78-18041
Aeromechanical stability of helicopters with a bearingless main rotor. Part 1: Equations of motion
[NASA-TM-78459] N78-18043
Limitations of the CH-47 helicopter in performing terrain flying with external loads
[AD-A048580] N78-18054
HELICOPTERS
Research requirements to reduce maintenance costs of civil helicopters
[NASA-CR-145288] N78-17990
Airworthiness evaluation NUH-1H helicopter with global positioning system
[AD-A047971] N78-18053
A personal cooling system for helicopter pilots
[AD-A047649] N78-18767
HELMETS
Emergency space-suit helmet
[NASA-CASE-MSC-10954-1] N78-18761
The helmet protects the aviator's head - or does it
[AD-A048574] N78-18766
HEMATOLOGY
Design of a blood-freezing system for leukemia research
[NASA-TP-1165] N78-18673
The hematic system in the set of symptoms of autonomic disorders in monkeys on the low gravitation stand
N78-18757
HEMATOPOIESIS
Hemopoiesis in dogs exposed to lethal doses of protons with shielded bone marrow
N78-18728
HEMISPHERICAL SHELLS
High durability missile domes
[AD-A048497] N78-18101
HEMODYNAMIC RESPONSES
Distinctive features of regional circulation and vasomotor regulation following a two-month space flight
N78-18718
HIERARCHIES
A distributed hierarchical computer system for laboratory automation
N78-18812
HIGH ALTITUDE BALLOONS
A new helicostat from SNIAS helicopter division
[NASA-TM-75063] N78-18041
HIGH FREQUENCIES
The geometrical theory of diffraction - a method for the solution of electromagnetic boundary value problems of complicated structures in the high frequency case — satellite and aircraft antennas
N78-18290
HIGH PRESSURE
High pressure hot pressing of tantalum carbide to attain a two hundred angstrom grain size
N78-18179
Velocities of compressional wave in rocks of central California at high pressure and high temperature and applications to the study of the crustal structure of California coast ranges
N78-18606
HIGH SPEED
Theoretical evaluation of high speed aerodynamics for arrow wing configurations
[NASA-TM-78659] N78-17992
High-speed fabrication of aspherical surfaces — for optical equipment
N78-18900
HIGH SPEED CAMERAS
Image restorations constrained by a multiply exposed picture
[LA-UR-77-1790] N78-18404
HIGH STRENGTH ALLOYS
High strength aluminum casting technology: Squeeze casting of 7075 alloy
[AD-A048657] N78-18192
HIGH STRENGTH STEELS
Segregation effects and the toughness of high-strength steels
[AD-A048448] N78-18193
HIGH TEMPERATURE
Hydrogen embrittlement of niobium 3: High temperature behavior
[AD-A047957] N78-18187
Velocities of compressional wave in rocks of central California at high pressure and high temperature and applications to the study of the crustal structure of California coast ranges
N78-18606
HIGH TEMPERATURE AIR
Thermal performance of MSFC hot air collectors under natural and simulated conditions
[NASA-CR-150506] N78-18525
HIGH TEMPERATURE PLASMAS
A study of stark broadening of high-z hydrogenic ion lines in dense hot plasmas
N78-18925
Atomic reactions in very high temperature plasmas
[CONF-770721-1] N78-18937
Steady state radiative cooling rates for low-density high-temperature plasmas
[PPPL-1352] N78-18940
HIGH TEMPERATURE RESEARCH
Thermophysical measurements on liquid metals above 4000 K
[UCRL-78782] N78-18200
HIGH TEMPERATURE TESTS
Resistance strain gages for stability experiments at temperatures up to 300 deg C
[NASA-TM-75246] N78-18392
EPA fabric filtration studies. 5: Bag cleaning technology, high temperature tests
[PB-274922/4] N78-18596
HIGH VOLTAGES
Semiconductor measurement technology: A versatile high-voltage bias supply for extended range MIS C[V] and G[V] measurements
[PB-274939/8] N78-18345
HIGHWAYS
Nondestructive inspection of steel, phase 1
[PB-274495/1] N78-18445
Estimated highway fuel savings in 1975
N78-18539
HILBERT SPACE
Graph-dense linear transformations in Hilbert space
N78-18868
HISTOCHEMICAL ANALYSIS
Histochemical study of digestive organs of rats following flight on Kosmos-605
N78-18722
HISTORIES
Pulkovo Observatory: An essay on its history and scientific activity
[NASA-TM-75083] N78-19012
HODOGRAPHS
Collection of supercritical aerofoils obtained with the NLR hodograph method
[NLR-TR-75115-U] N78-18009
HOLOGRAPHY
Holographic combiners for head-up displays
[AD-A047998] N78-18064
Designing holographic optical elements
N78-18389
Wideband holographic digital recording and reproduction
[AD-A048464] N78-18401
Applications of quantum electronics. Part 3: Holographic couplers for optical fibre bundles
[OUEL-1185/77-PT-3] N78-18919
HOMOTOPY THEORY
Time-dependent mathematical programs
[AD-A048428] N78-18852
Fake quaternionic projective spaces from a homotopy point of view
N78-18869
HORIZONTAL TAIL SURFACES
Calculation of the horizontal tail loads from elevator actuation
[DLR-IB-536-76/4] N78-18011
HOSES
Phosphonitrilic fluoroelastomer fuel hose. Utilization of extruded tubes
[AD-A047960] N78-18432
HOT ELECTRONS
Optically induced hot electron effects in semiconductors
[AD-A048194] N78-18956
HOT PRESSING
Flight qualification of titanium F-14A airframe components manufactured by Hot Isostatic Pressing [HIP]
[AD-A048485] N78-18055
High pressure hot pressing of tantalum carbide to attain a two hundred angstrom grain size
N78-18179
HOT WORKING
Hot forming of silicon sheet, silicon sheet growth development for the large area silicon sheet task of the low cost silicon solar array project
[NASA-CR-155934] N78-18517
HOUSEKEEPING [SPACECRAFT]
A study of the pulsed method of laundering
N78-18692
HUDSON RIVER [NY]
Evaluation of circulation in partially stratified estuaries as typified by the Hudson River
N78-18476
HULLS [STRUCTURES]
Supporting investigations during testing of the WDL-1 airship in Ghana and Upper Volta — hull temperature, flight data, operational problems
[DLR-IB-536-77/1] N78-18012
HUMAN BODY
Evaluation of postural mechanisms under dynamic conditions
[NASA-CR-151638] N78-18700
Selected design parameters for reclining seats based on engineering anthropometry
[AD-A048458] N78-18769
HUMAN FACTORS ENGINEERING
Space Biology and Aerospace Medicine, no. 4, 1977
[JPRS-69964] N78-18738
A new approach toward obtaining quantified subjective test data
[AD-A047838] N78-18764
An introduction to V/STOL technology affecting the pilot's role
[AD-A048214] N78-18765
Human Engineering Laboratory Identification Friend or Foe test [HELIFF]
[AD-A048784] N78-18768
Selected design parameters for reclining seats based on engineering anthropometry
[AD-A048458] N78-18769
HUMAN PERFORMANCE
A new approach toward obtaining quantified subjective test data
[AD-A047838] N78-18764
HYBRID PROPELLANT ROCKET ENGINES
Hybrid propulsive systems: Technology and application
[DLR-IB-456-76/11] N78-18126
HYBRID PROPELLANTS
Boron combustion in combinatory propulsion
[DLR-IB-456-77/8] N78-18229
HYBRID PROPULSION
Tripropellant engine study
[NASA-CR-150562] N78-18119
HYDRAULIC FLUIDS
Effect of hydraulic fluid [MIL-H-83282] on selected commercial O-ring compounds
[NASA-TM-78154] N78-18213
HYDRAULIC JETS
Deflected heated water jets, theory and experiments
N78-18354
HYDROCARBON COMBUSTION
Emission formation in heterogeneous combustion
[PB-274599/0] N78-18163
HYDROCARBONS
Matrix isolation Fourier transform infrared spectroscopy of polycyclic aromatic hydrocarbons
N78-18146
Matrix isolation fluorescence spectroscopy of polycyclic aromatic hydrocarbons
N78-18147
HYDRODYNAMICS
The movement of a wing with deflected ailerons close to a screen
[AD-A048651] N78-18004
Hydro code study
[AD-A048553] N78-18093
Reaction kinetics and structure of enzyme macromolecules subjected to hydrodynamic shearing forces: Enzyme mechanochemistry
N78-18210
Experimental and analytical study on the stability of a bounded jet at low Reynolds numbers
N78-18349

Transient free-surface hydrodynamics — a finite difference scheme for a Lagrangian formulation of inviscid incompressible flow
[AD-A048749] N78-18368
HYDROGEN
The thermodynamic properties of slush hydrogen and oxygen
[NASA-CR-155743] N78-18168
Electromigration of hydrogen and deuterium in vanadium, niobium and tantalum
N78-18177
On the oxidation of niobium in pure hydrogen atmospheres
[AD-A047963] N78-18185
The 16 to 40 micron spectra of Jupiter and Venus — far infrared absorption of hydrogen and sulfuric acid
N78-19008
HYDROGEN ATOMS
Synthesis of silane and silicon in a non-equilibrium plasma jet
[NASA-CR-155933] N78-18518
HYDROGEN BONDS
Polarized infrared spectral studies of crystalline, hydrogen-bonded organic acids
[AD-A048587] N78-18162
HYDROGEN EMBRITTLEMENT
The role of trapping on hydrogen transport and embrittlement
N78-18175
Hydrogen embrittlement of niobium 3: High temperature behavior
[AD-A047957] N78-18187
HYDROGEN IONS
A study of stark broadening of high-z hydrogenic ion lines in dense hot plasmas
N78-18925
HYDROGEN OXYGEN ENGINES
Equations for approximating the thermodynamic data of a hydrogen/oxygen steam generator — exhaust gas temperature and characteristic velocity
[DLR-IB-456-77/9] N78-18964
HYDROLOGY
Compendium of training facilities in environmental problems related to meteorology and operational hydrology
[WMO-489] N78-18644
Compendium of meteorology. Volume 2, part 1: General hydrology
[WMO-364] N78-18650
HYPERBARIC CHAMBERS
A sensor for the detection of CO2 in hyperbaric gaseous environments
[AD-A048599] N78-18400
HYPERFINE STRUCTURE
A computer program for analyzing unresolved Mossbauer hyperfine spectra
[NASA-TM-78633] N78-18796
HYPERGEOMETRIC FUNCTIONS
Approximation of a completely monotone function
[AD-A048249] N78-18842
HYPERTENSION
Prevention of hypertensive states in ship crews out at sea
N78-18759
HYPERVELOCITY IMPACT
Hydro code study
[AD-A048553] N78-18093
HYPOKINESIA
Parameters of acid-base equilibrium and enzymatic activity of blood in man during brief antiorthostatic hypokinesia
N78-18687
Lactate dehydrogenase isozymes of rat skeletal muscles following a space flight and with hypokinesia
N78-18689
Mucopolysaccharides and collagen of tissues in hypokinetic rats
N78-18723
Effect of prolonged hypokinesia on the course of acute aseptic inflammation
N78-18747
HYPOTHESES
Hypothesis testing for the parameters of a covariance matrix having linear structure
N78-18829
HYPOXIA
Organism reactions to hypoxia following exposure to gamma radiation
N78-18750
Changes in circulating blood volume and filling of the brain and internal organs of rats following acute and chronic hypoxia
N78-18756
HYSTERESIS
Mathematical model for rubber hysteresis
N78-18450

I

IBM COMPUTERS
FORTRAN complier validation summary report
[AD-A048353] N78-18781
ICE FORMATION
The geology of the Great Lakes ice cover
N78-18601
IGNITION
Ignition criteria for non-premixed stagnation point flow
N78-18352
IMAGE ENHANCEMENT
A maximal chromatic expansion method of mapping multichannel imagery into color space — North Dakota
[E78-10075] N78-18484
On the possibilities of on-line image restoration by means of a finite impulse response filter
[THT-TM-77-020] N78-18915
IMAGE INTENSIFIERS
Magnifying image intensifier
[NASA-CASE-GSC-12010-1] N78-18905
IMAGE PROCESSING
Synthetic aperture radar image processing techniques development and evaluation
[AD-A048193] N78-18269
Segmentation and structure analysis for real-time video target tracking
[AD-A048156] N78-18270
WALSHSTORE: The application of burst processing to fail-soft storage systems using Walsh transforms
[AD-A047889] N78-18774
The filtering of images using a new fidelity criterion
[PB-274532/1] N78-18787
Quantization of image transforms with minimum distortion
[PB-274533/9] N78-18788
Speckle gram data reduction using optical and digital techniques
[AD-A048210] N78-18907
IMAGING TECHNIQUES
Full color hybrid display for aircraft simulators — landing aids
[NASA-CASE-ARC-10903-1] N78-18083
Image restorations constrained by a multiply exposed picture
[LA-UR-77-1790] N78-18404
IMIDES
The photochemistry of amides and phthalimides
N78-18149
IMP
Solar-Geophysical data number 397, September 1977. Part 2: Data for March - February 1977 and miscellanea
[PB-274824/2] N78-19024
IMPACT ACCELERATION
Acute leukocytic reactions to impact accelerations
N78-18752
IMPACT DAMAGE
Impact damage in brittle materials in the plastic response regime
[AD-A048266] N78-18430
IMPACT STRENGTH
Hydro code study
[AD-A048553] N78-18093
IMPELLERS
Investigation of the jet wake discharge flow of a heavily loaded centrifugal compressor impeller
[DLR-FB-77-32] N78-18073
IMPLANTATION
The chemical, mechanical, and implant properties of glass-coated alumina
N78-18130
IMPLANTED ELECTRODES [BIOLOGY]
Effect of surface texture by ion beam sputtering on implant biocompatibility and soft tissue attachment
[NASA-CR-135311] N78-18672
IMPULSES
Nerve form and function: Some cellular aspects of action potential initiation and propagation
N78-18698
On the possibilities of on-line image restoration by means of a finite impulse response filter
[THT-TM-77-020] N78-18915
IMPURITIES
Segregation effects and the toughness of high-strength steels
[AD-A048448] N78-18193
Theory of bound states associated with n-type inversion layers on silicon
[AD-A048216] N78-18960
IN-FLIGHT MONITORING
Main results of medical research conducted during the flight of two crews on the Salyut-5 orbital station
N78-18684
INCOMPRESSIBILITY
Transient free-surface hydrodynamics — a finite difference scheme for a Lagrangian formulation of inviscid incompressible flow
[AD-A048749] N78-18368
INCOMPRESSIBLE FLOW
A computational model for three-dimensional incompressible small cross flow wall jets
[AD-A048450] N78-18008
Theoretical investigation of the viscid flow around a flat plate with ground effect
[DLR-FB-77-35] N78-18016
Unsteady pressure measurements on wing-store combinations in incompressible flow
[ESA-TT-426] N78-18018
Testing of turbulence models by exact numerical solution of the Navier-Stokes equations
[AD-A048199] N78-18365
A two dimensional MHD model for magnetic field line reconnection in an incompressible and inviscid plasma
N78-18604
INCOMPRESSIBLE FLUIDS
The existence of instationary flows in incompressible micropolar fluids
N78-18249
INDEPENDENT VARIABLES
On rules based on sample medians for selection of the largest location parameter
[AD-A047948] N78-18860
INDEXES [DOCUMENTATION]
Index of ELDO publications
[ESA-SP-1006] N78-18102
File organisation and access techniques. A selective bibliography
[BLL-BLRDR-5414-[2113.56F]]
N78-18981
Indexing of structural data on chemical compounds in British universities
[BLL-BLRDR-5355-[2113.56F]]
N78-18982
INDIUM ANTIMONIDES
Theory of surface polaritons in n-InSb in the presence of a DC current and an external DC magnetic field
[AD-A048217] N78-18959
INDIUM COMPOUNDS
Investigation of laser optical biasing on the quantum transport properties of n-InSb
[AD-A048229] N78-18414
INDIUM PHOSPHIDES
Computer simulation of InP transferred-electron devices designed for Ka-band operation
N78-18303
INDUCTANCE
Partial discharges in the transformers due to induced voltages
[NASA-TM-75256] N78-18310
INDUSTRIAL WASTES
Compliance status of major air pollution facilities
[PB-275005/7] N78-18581
INDUSTRIES
Manganese - 1977
[PB-274070/2] N78-18205
Industrial ion source technology — for ion beam etching, surface texturing, and deposition
[NASA-CR-135353] N78-18883
INERTIAL GUIDANCE
Ambiguous range study report
[AD-A048612] N78-18033
IUS prerelease alinement
[NASA-TM-79349] N78-18104
INERTIAL NAVIGATION
Micro navigator [MICRON] phase 2B. Volume 1: Technical report
[AD-A048000] N78-18030
INFECTIOUS DISEASES
Effect of prolonged hypokinesia on the course of acute aseptic inflammation
N78-18747
INFERENCE
Inductive extrapolation: A system for program synthesis from exemplary data employing regular grammar inference and polynomial separation of machine states
N78-18789
INFLATABLE STRUCTURES
Preliminary tests of inflatable liferafts for stability in high winds
[AD-A048722] N78-18023
Emergency space-suit helmet
[NASA-CASE-MSC-10954-1] N78-18761
INFORMATION
Design of a production system for cognitive modelling number 1
[AD-A048196] N78-18826
INFORMATION DISSEMINATION
Survey: Automated Field Operations and Services [AFOS]
[NASA-CR-150548] N78-18261
Evoked cortical potentials and information processing
[AD-A048647] N78-18760
NUSC technical publication guidelines
[AD-A048066] N78-18978
INFORMATION MANAGEMENT
What the next decade is going to bring
[NASA-TM-79361] N78-18976
INFORMATION RETRIEVAL
A comparative evaluation of searching by controlled language and natural language in an experimental NASA data base
[ESA-CR[P]-1009] N78-18979
Augmentation of a text retrieval system with an intelligent graphics terminal
[NPL-COM-86] N78-18980

File organisation and access techniques. A selective bibliography
[BLL-BLRDR-5414-[2113.56F]]
N78-18981

INFORMATION SYSTEMS
Digital Avionics Information System [DAIS]: Mid-1980's maintenance analysis
[AD-A047886] N78-18063
Palefac
[AD-A048331] N78-18065
Sensors Workshop summary report
[NASA-TM-74978] N78-18498
WISP information display system user's manual
[NASA-CR-150541] N78-18623
Optimal data storage and organization in computerized information processing systems subject to failures
N78-18974
Accessing numeric data via flags and tags: A final report on a real world experiment
[NASA-TM-79326] N78-18975
Research on information system specification
[AD-A047864] N78-18977
Information and technology transfer program for the National Science Foundation
[PB-274259/1] N78-18991
HUD/PTI Information Systems Improvement Program. An orientation to comprehensive information systems improvement for a local government
[PB-274177/5] N78-18994
HUD/PTI Information Systems Improvement Program: Transfer analysis methodology guide
[PB-274178/3] N78-18995
HUD/PTI Information Systems Improvement Program: Information systems analysis methodology guide
[PB-274180/9] N78-18997

INFRARED DETECTORS
A sensor for the detection of CO2 in hyperbaric gaseous environments
[AD-A048599] N78-18400
The development of a parallel-channel spectrographic detector: Applications to Raman scattering
N78-18903
Study of HgCdTe MIS technology
[AD-A048224] N78-18954

INFRARED INTERFEROMETERS
Over-under double-pass interferometer
[NASA-CASE-NPO-13999-1] N78-18395
Notes on design of high efficiency beam dividers for two beam infra-red interferometers
[NPL-QU-41] N78-18406

INFRARED RADIATION
Sea surface temperature determination from infrared radiation. A critical evaluation of the method — coastal water circulation study
[KNMI-WR-77-5] N78-18669
Determination of optical constants of phosphates, sulphates and ammonia and related compounds in the near infrared region
[AD-A048173] N78-18908
The AFGL four color infrared sky survey: Supplemental catalog
[AD-A048048] N78-19014

INFRARED SPECTRA
Polarized infrared spectral studies of crystalline, hydrogen-bonded organic acids
[AD-A048587] N78-18162

INFRARED SPECTROMETERS
A practical Hadamard spectrometer for astronomical application
N78-19007

INFRARED SPECTROSCOPY
Matrix isolation Fourier transform infrared spectroscopy of polycyclic aromatic hydrocarbons
N78-18146
Infrared Fourier transform spectroscopy of chromatographically separated species
N78-18151
Fourier transform infrared spectroscopy: Demonstration of measurement capabilities in the laboratory and the field
[RM-648] N78-18157

INHOMOGENEITY
Theory of the galvanomagnetic properties of inhomogeneous metals: Application to copper
N78-18184

INLET FLOW
Effect of design changes on aerodynamic and acoustic performance of translating-centerbody sonic inlets
[NASA-TP-1132] N78-17998

INLET NOZZLES
Studies of heat transfer to gas turbine components
[AD-A048551] N78-18071

INORGANIC COMPOUNDS
Indexing of structural data on chemical compounds in British universities
[BLL-BLRDR-5355-[2113.56F]]
N78-18982

INPUT/OUTPUT ROUTINES
Automatic generation of segmentation directives on the CDC 6600 computer
[AD-A047782] N78-18777

INSTALLATION MANUALS
Installation package - SIMS prototype system 1A
[NASA-CR-150524] N78-18523

INSTRUMENT ERRORS
The use of pyranometers in aircraft
[ESA-TT-433] N78-18408

INSULATION
Study of the physics of insulating films as related to the reliability of metal-oxide semiconductor devices
[AD-A048483] N78-18328
Effective thermal conductivity determination for low-density insulating materials
[NASA-TP-1155] N78-18364

INTEGRAL EQUATIONS
The integral equation method - a computational method for diffracted and scattered fields of complicated structures — satellite and aircraft antennas
N78-18291

INTEGRATED CIRCUITS
High speed micro signal processor study
[AD-A047997] N78-18322
Cost and reliability aspects of large CMOS integrated circuits for fuzing applications
[AD-A048276] N78-18329
The role of the Department of Defense in the development of integrated circuits
[AD-A048610] N78-18332
Microbeam analysis techniques for ICS
[AD-A048482] N78-18338
IC fabrication using electron-beam technology
[AD-A048307] N78-18886
Study of HgCdTe MIS technology
[AD-A048224] N78-18954

INTELSAT SATELLITES
Development of a satellite flywheel family operating on one active axis magnetic bearings
N78-19043

INTERFEROMETERS
FORTRAN program to determine length of gage blocks using single wavelength interferometry
[PB-274895/2] N78-18811

INTERFEROMETRY
Full-field determination of the first derivative of normal surface displacement of thin plates using speckle photographic interferometry
N78-18446
Electron number density measurement by ruby laser interferometry in a CO2 laser-induced gas breakdown plasma
[CONF-770725-1] N78-18938

INTERIM STAGES [SPACECRAFT]
IUS/payload communication system simulator configuration definition study — payload simulator for pcm telemetry
[NASA-CR-151620] N78-18259

INTERIM UPPER STAGE [STS]
IUS prerelease alinement
[NASA-TM-79349] N78-18104

INTERNAL COMBUSTION ENGINES
An experimental determination of the history of formation of the cylinder averaged oxides of nitrogen in diesel combustion
N78-18143
Emission formation in heterogeneous combustion
[PB-274599/0] N78-18163
Alternative automotive engines and energy conservation
N78-18534
State-of-the-art assessment of electric vehicles and hybrid vehicles
[NASA-TM-73756] N78-18988

INTERNATIONAL COOPERATION
International transfer of marine technology, a three-volume study — social, political and economic factors
[PB-275353/1] N78-18986

INTERSTELLAR MATTER
The interaction of a strong stellar wind with the interstellar medium
N78-19015

INTRAMOLECULAR STRUCTURES
Structure and intramolecular interconversions of some organometallic complexes
N78-18170
The structure of complexes of mono- and polynucleotides with metal ions of the first transition group. Part 1: Crystallographic studies
[ISS-R-76/7-PT-1] N78-18891
The structure of complexes of mono- and polynucleotides with metal ions of the first transition group. Part 2: Nuclear magnetic resonance studies
[ISS-R-76/8-PT-2] N78-18892
Relaxation of the bending mode of carbon dioxide by vibration to rotation and vibration to vibration energy transfer
N78-18951

INTRAOCULAR PRESSURE
Sudden loss of consciousness in pilots with low intraocular pressure during exposure to G forces
N78-18737

INVARIANT IMBEDDINGS
The application of invariant imbedding to problems in elastic stability
N78-18453

INVENTORIES
Cropland inventories using an orbital imaging radar
N78-18478

INVERTERS
Low-cost light-weight efficient 1.5 kW inverters with and without output transformers
[AD-A048449] N78-18327

INVESTMENTS
An experiment on executive decision making
[AD-A047888L] N78-18970

INVISCID FLOW
Inviscid, nonadiabatic flow fields over blunt, sonic corner bodies for outer planet entry conditions by a method of integral relations
[NASA-TP-1133] N78-18363
Transient free-surface hydrodynamics — a finite difference scheme for a Lagrangian formulation of inviscid incompressible flow
[AD-A048749] N78-18368
Numerical solution of viscous-inviscid interaction problems in two-dimensional compressible flows based on the Navier-Stokes equations
N78-18378
Viscid-inviscid interaction methods for two-dimensional flows, including separation and shock waves
N78-18379
Inviscid fluid models, based on rolled-up vortex sheets, for three-dimensional separation at high Reynolds number
N78-18384
A two dimensional MHD model for magnetic field line reconnection in an incompressible and inviscid plasma
N78-18604

ION ACOUSTIC WAVES
Reflection and absorption of ion-acoustic waves in a plasma density gradient
N78-18926

ION ATOM INTERACTIONS
Intense focussed ion beams and their interaction with matter
[AD-A048753] N78-18887

ION BEAMS
Microbeam analysis techniques for ICS
[AD-A048482] N78-18338
Effect of surface texture by ion beam sputtering on implant biocompatibility and soft tissue attachment
[NASA-CR-135311] N78-18672
Industrial ion source technology — for ion beam etching, surface texturing, and deposition
[NASA-CR-135353] N78-18883
Intense focussed ion beams and their interaction with matter
[AD-A048753] N78-18887

ION CONCENTRATION
Electrolyte content of blood and potassium ion transport in erythrocytes of animals exposed to a steady magnetic field
N78-18727

ION EXCHANGE MEMBRANE ELECTROLYTES
Anion permselective membrane
[NASA-CR-135316] N78-18515

ION EXCHANGING
Effects of pressure on ion exchange and ion pairing chromatography
N78-18154

ION PROBES
Multivariate analysis of atmospheric particulate composition and computer-controlled interference correction for ion-selective electrode measurements in a flowing stream
N78-18569

ION PROPULSION
Ion Propulsion Module [IPM] technology readiness assessment: 1985 Halley's Comet rendezvous mission
[NASA-CR-155308] N78-18120

ION SCATTERING
Coupled-channel analysis for heavy-ion induced scattering and transfer reactions
N78-18894

ION SOURCES
Reflex tetrode with unidirectional ion flow
[AD-A048751] N78-18336
Industrial ion source technology — for ion beam etching, surface texturing, and deposition
[NASA-CR-135353] N78-18883

IONIZATION
Evolution of a test particle distribution function in a partially ionized plasma
N78-18923

IONIZATION CROSS SECTIONS
Photon interactions with atmospheric negative ions
[AD-A048315] N78-18611

IONOSPHERE
Adaptive mapping of mid-latitude ionosphere
[AD-A048116] N78-18607
Correlation distance of mean daytime electron content
[AD-A048117] N78-18608

IONOSPHERIC DISTURBANCES
Morphological studies of rising equatorial spread F bubbles
[AD-A048752] N78-18612

IONOSPHERIC PROPAGATION
Prediction of transionospheric signal time delays using correlative techniques
[AD-A047917] N78-18268
IRON
Real-time computer optimized scanning potential coulometry for multi-component trace analysis
N78-18152
Ductile fracture initiation in pure alpha-FE
N78-18181
Optical dispersion and electrical transport studies of iron intercalated zirconium diselenide
N78-18906
IRON ALLOYS
Tantalum modified ferritic iron base alloys
[NASA-CASE-LEW-12095-1] N78-18182
Research on martensitic transformations in iron alloys
[AD-A047940] N78-18189
ISOMERS
Structure and intramolecular interconversions of some organometallic complexes
N78-18170
ISOSTATIC PRESSURE
Flight qualification of titanium F-14A airframe components manufactured by Hot Isostatic Pressing [HIP]
[AD-A048485] N78-18055
ISOTOPIC LABELING
Investigations of rocket propellants using tracers. Life testing of plastic propellant gases
[BMVG-FBWT-77-14] N78-18228
ITALY
Experimental measurements for the evaluation of the accuracy of tipping-bucket rain gauges used in the research program on radio propagation frequencies above 10 GHz
N78-18653
NEXT - instruction manual — nationwide evaluations of X-ray trends
[ISS-T-77/1] N78-18889
ITERATION
Quasi-Newton Methods
[NASA-CR-151637] N78-18871
IUE
Focus drive mechanism for the IUE scientific instrument
N78-19045

J

JAMMING
Determination of antenna radiation patterns, radar cross sections and jam-to-signal ratios by flight tests
[NLR-MP-76023-U] N78-18289
JAPAN
On the development of earth observation satellite systems
[NASA-TM-75064] N78-18490
JAPANESE SPACE PROGRAM
Outline of the survey on the development of earth observation satellites
[NASA-TM-75065] N78-18491
JET AIRCRAFT NOISE
Concorde noise-induced building vibrations John F. Kennedy International Airport
[NASA-TM-78660] N78-18873
Acoustic interference effects and the role of Helmholtz number in aerodynamic noise
[DLR-IB-257-77/11] N78-18878
JET ENGINE FUELS
Comparison tests on the 100-GPM electrokinetic fuel decontaminator and a 100-GPM military standard filter/separator
[AD-A048655] N78-18226
JET ENGINES
Composite hub/metal blade compressor rotor
[NASA-CR-135343] N78-18131
JET FLAPS
Cambered jet-flapped airfoil theory with tables and computer programs for application
[AD-A048528] N78-18006
JET FLOW
Temperature dependence of jet swell and material functions in polymer melt systems
N78-18206
Experimental and analytical study on the stability of a bounded jet at low Reynolds numbers
N78-18349
Effects of vertical distortion on thermalhydraulic modeling of surface discharges
N78-18479
JET PROPULSION
Studies of gas injection into a liquid stream
[OUEL-1216/77] N78-18373
JETTISON SYSTEMS
Cartridge firing device designed for attachment, release and ejection of a satellite
N78-19033
JOINTS (ANATOMY)
Spacesuit mobility joints
[NASA-CASE-ARC-11058-2] N78-18763
JUPITER ATMOSPHERE
The 16 to 40 micron spectra of Jupiter and Venus — far infrared absorption of hydrogen and sulfuric acid
N78-19008

K

KALMAN FILTERS
Flight-path reconstruction of symmetric nonsteady flights
[NLR-TR-76133-U] N78-18056
Improvement of flight measuring data with a Kalman filter
[BMVG-FBWT-77-6] N78-18057
The discrete-time compensated Kalman filter
[NASA-CR-2916] N78-18822
KIDNEYS
Morphological manifestations of functional changes in the hypothalamo-hypophyseal neurosecretory system and rat kidneys under the influence of space flight factors
N78-18690
KINEMATIC EQUATIONS
An algorithmic approach for reducing kinematically similar differential systems
[AD-A047781] N78-18845
KINEMATICS
Archives of Mechanics, volume 29, issue 5
N78-18240
Disclination kinematics
N78-18241
The kinematics of breaking waves in the surf zone
[AD-A048723] N78-18666
KINETICS
Mechanisms and kinetics of binary alkali silicate glass corrosion
N78-18207
KRYPTON
Low-energy electron diffraction from epitaxial solid krypton layers on graphite
N78-18946

L

LABORATORY EQUIPMENT
Fourier transform infrared spectroscopy: Demonstration of measurement capabilities in the laboratory and the field
[RM-648] N78-18157
Accelerated laboratory corrosion test for materials and finishes used in naval aircraft
[AD-A048059] N78-18188
LAGRANGE COORDINATES
Transient free-surface hydrodynamics — a finite difference scheme for a Lagrangian formulation of inviscid incompressible flow
[AD-A048749] N78-18368
LAMINAR BOUNDARY LAYER
A simple finite difference technique for the computation of three-dimensional incompressible laminar boundary layers. Part 1: Description of the method
[NLR-TR-76086-U] N78-18371
LAMINAR FLOW
Drag, flow transition, and laminar separation on nine bodies of revolution having different forebody shapes
[AD-A048274] N78-18001
Theoretical investigation of the viscid flow around a flat plate with ground effect
[DLR-FB-77-35] N78-18016
Split-operator, finite difference solution for axisymmetric laminar jet diffusion flames
[SAND-77-8502] N78-18079
A review of theories for the fluid dynamic effects of roughness on laminar lubricating films
[AD-A048333] N78-18217
LAMINATES
Stress fields in composite laminates
[AD-A048565] N78-18139
Transient temperatures in laminated composite conical shells due to aerodynamic heating
N78-18360
Users' instructions for the NASA/MSFC cloud-rise preprocessor program, version 6, and the NASA/MSFC multilayer diffusion program, version 6: Research version for Univac 1108 system
[NASA-CR-2945] N78-18573
LANCE MISSILE
The 14818C lance missile number 3292, round number 298 APT, 24 August 1977
[AD-A048321] N78-18640
Meteorological data report. 12828F Lance missile no. 2215, round no. 302 RSL, 6 October 1977
[AD-A048273] N78-18642
Meteorological data report. 14821A Lance missile no. 3296, round no. 303 APT, 10 November 1977
[AD-A048272] N78-18643
LAND MANAGEMENT
Application of remote sensing data to surveys of the Alaskan environment
[E78-10077] N78-18486
LAND USE
Cost benefit analysis of the transfer of NASA remote sensing technology to the state of Georgia
[E78-10076] N78-18485
Outline of the survey on the development of earth observation satellites
[NASA-TM-75065] N78-18491
Potential for betterment district financing and joint development applications to surface transit
[PB-274618/8] N78-19005
LANDAU DAMPING
A perturbation expansion for the nonlinear Schrodinger equation with application to the influence of nonlinear Landau damping
[IPPJ-315] N78-18931
Modulated langmuir waves and nonlinear Landau damping — Schroedinger equation
[IPPJ-319] N78-18935
LANDING AIDS
Full color hybrid display for aircraft simulators — landing aids
[NASA-CASE-ARC-10903-1] N78-18083
LANDSAT C
Improved LANDSAT to give better view of earth resources
[NASA-NEWS-RELEASE-78-22] N78-18480
LANDSAT D
Post LANDSAT D Advanced Concept Evaluation (PLACE) — with emphasis on mission planning, technological forecasting, and user requirements
[NASA-CR-155769] N78-18499
LANDSAT 1
Cumulative non-US standard catalog — LANDSAT imagery for 1976 - 1977
[NASA-TM-79359] N78-18509
Cumulative US standard catalog — LANDSAT imagery for 1976 - 1977
[NASA-TM-79358] N78-18510
LANGUAGE PROGRAMMING
The process of question answering
N78-18790
LANGUAGES
A comparative evaluation of searching by controlled language and natural language in an experimental NASA data base
[ESA-CR(P)-1009] N78-18979
LANTHANUM COMPOUNDS
Large-aperture optical modulator materials. Lead lanthanum zirconate titanate ceramic and lithium niobate crystal show promise as modulator materials for optical transmitters with up to 6-inch apertures
[AD-A048163] N78-18909
LAPLACE TRANSFORMATION
Numerical experiments concerning the eigenvalues of the Laplacian on a Zoll surface
N78-18836
Distribution of a sum of order statistics from the gamma distribution
[AD-A048127] N78-18859
LARGE AREA CROP INVENTORY EXPERIMENT
A maximal chromatic expansion method of mapping multichannel imagery into color space — North Dakota
[E78-10075] N78-18484
LARGE SPACE TELESCOPE
Optimal control of a large space telescope using an annular momentum control device
N78-18428
LASER APPLICATIONS
JASON laser propulsion study, summer 1977
[AD-A047901] N78-18412
Methods for indirect wind measurement — laser and acoustic appliations
[DLR-IB-553-77/5] N78-18646
Applications of quantum electronics. Part 1: The scanning optical microscope
[OUEL-1183/77-PT-1] N78-18917
The scanning optical microscope
[OUEL-1220/77] N78-18920
Calculations of the optical properties of laser-induced plasmas in solid bodies — laser weapons target acquisition
[DLR-IB-551-77/6] N78-18943
LASER DOPPLER VELOCIMETERS
Laser velocimeter survey about a NACA 0012 wing at low angles of attack
[NASA-TM-74040] N78-18084
LASER FUSION
Development of cryogenic targets for laser fusion
[LA-UR-77-1523] N78-18936
LASER MATERIALS
Macroscopic description of laser-type matter
[AD-A048442] N78-18422
LASER OUTPUTS
Optically induced hot electron effects in semiconductors
[AD-A048194] N78-18956
LASER PLASMA INTERACTIONS
Electron number density measurement by ruby laser interferometry in a CO2 laser-induced gas breakdown plasma
[CONF-770725-1] N78-18938
LASER PLASMAS
Microwave simulation of laser plasma interactions
[UCRL-13752] N78-18423

Calculations of the optical properties of laser-induced plasmas in solid bodies --- laser weapons target acquisition
[DLR-IB-551-77/6] N78-18943
LASERS
Improved quantum receivers for optical communication
[AD-A048688] N78-18280
Wideband holographic digital recording and reproduction
[AD-A048464] N78-18401
Aerodynamic stabilization of gaseous discharges
[AD-A048533] N78-18415
Laser pulse speckle effects
[AD-A048598] N78-18421
A digital frequency-offset lock system designed for use with stabilized lasers
[NPL-QU-40] N78-18424
LATITUDE
Systems for the determination of polar motion
[PB-274698/0] N78-18617
LATTICE PARAMETERS
A neutron scattering study of monolayer nitrogen films
N78-18944
LAW [JURISPRUDENCE]
State solar energy legislation of 1976: A review of statutes relating to buildings
[PB-273899/5] N78-18567
Massachusetts coastal zone management program, volume 1
[PB-274031/4] N78-18667
LEADING EDGES
A theoretical investigation of the aerodynamics of low-aspect-ratio wings with partial leading-edge separation
[NASA-CR-145304] N78-17993
LEAKAGE
Analysis of leak currents in field effect transistors with a submicron Schottky gate
[LCR-450/258] N78-18343
LEARNING
The independent learning project: A study of changing attitudes in American public libraries
[BLL-BLRDR-5396-(2113.56F)]
N78-18984
LEARNING MACHINES
Applications of pattern recognition and learning controllers to power system analysis and control
N78-18819
LEARNING THEORY
Effects of two calculus treatments upon achievement and critical thinking ability
N78-18833
LECTURES
Compendium of meteorology. Volume 2, part 1: General hydrology
[WMO-364] N78-18650
LEGENDRE FUNCTIONS
Studies in application of discrete ordinates transport methods to light transport calculations: Preparation of Mie theory cross sections in Legendre polynomials
[AD-A048614] N78-18913
LENTICULAR BODIES
Photometric study of the structure of lenticular galaxies
N78-19009
LETHALITY
Hemopoiesis in dogs exposed to lethal doses of protons with shielded bone marrow
N78-18728
LEUKOCYTES
Acute leukocytic reactions to impact accelerations
N78-18752
LIBRARIES
Developing an acquisitions system for a university library
[BLL-BLRDR-5351] N78-18983
The independent learning project: A study of changing attitudes in American public libraries
[BLL-BLRDR-5396-(2113.56F)]
N78-18984
LIBRATION
Stress and vibration analysis of orthotropic shells of revolution
N78-18449
LIFE [DURABILITY]
High durability missile domes
[AD-A048497] N78-18101
LIFE CYCLE COSTS
Sea nymph pilot LCC model development
[AD-A048109] N78-18278
Joint design-to-cost guide. Life cycle as a design parameter
[AD-A048254] N78-18965
LIFE RAFTS
Preliminary tests of inflatable liferafts for stability in high winds
[AD-A048722] N78-18023
LIFE SCIENCES
Synthesis and biological screening of novel hybrid fluorocarbon hydrocarbon compounds for use as artificial blood substitutes
[NASA-CR-155781] N78-18702
LIFT
Analytical study of a free-wing/free-trimmer concept — for gust alleviation and high lift
[NASA-CR-2946] N78-18000
Study of an air lift pump in a centrifugal force field
[DLR-FB-77-40] N78-18436
LIGANDS
An investigation of metal versus ligand centered redox processes in selected transition metal macrocyclic complexes. The application of a microcomputer to voltammetry
N78-18153
LIGHT [VISIBLE RADIATION]
The national measurement system for radiometry and photometry
[PB-274643/6] N78-18256
LIGHT MODULATION
Large-aperture optical modulator materials. Lead lanthanum zirconate titanate ceramic and lithium niobate crystal show promise as modulator materials for optical transmitters with up to 6-inch apertures
[AD-A048163] N78-18909
LIGHT SCATTERING
Intensity, angular distribution and polarization of spontaneous molecular light scattering
[ESA-TT-438] N78-18298
Studies in application of discrete ordinates transport methods to light transport calculations: Preparation of Mie theory cross sections in Legendre polynomials
[AD-A048614] N78-18913
LIGHTNING
The distribution of thunderstorm days, lightning discharges, and the incidence of lightning discharge derived from VLF sferics data
[AD-A048271] N78-18634
A network of lightning counters in the Netherlands
[KNMI-WR-77-6] N78-18647
LIMBS [ANATOMY]
Vestibulotonic reflexes in muscles of the rat hind limb following a flight on Kosmos-605
N78-18745
LINEAR EQUATIONS
Graph-dense linear transformations in Hilbert space
N78-18868
LINEAR FILTERS
The filtering of images using a new fidelity criterion
[PB-274532/1] N78-18787
LINEAR PROGRAMMING
Network versus linear programming algorithms and implementations
[AD-A048296] N78-18804
On the use of matrix factorization techniques in penalty fu ion methods for structured linear programs
[IIASA-RM-77-21] N78-18810
Generalized networks: A fundamental computer-based planning tool
[AD-A048297] N78-18814
LINEAR SYSTEMS
Improvement of modal methods for dynamic response problems of linear elastic structures
[DLR-FB-77-33] N78-18474
Direct solutions of large, sparse linear systems
[AD-A047776] N78-18843
LINEAR TRANSFORMATIONS
Graph-dense linear transformations in Hilbert space
N78-18868
LINES OF FORCE
A two dimensional MHD model for magnetic field line reconnection in an incompressible and inviscid plasma
N78-18604
LININGS
Amalgam stabilization by selective interfacial amalgamation — polyacrylate dental cavity linings
N78-18178
LIPIDS
Carbohydrate and lipid content of rat liver tissue following a 22-day space flight
N78-18755
LIQUID CHROMATOGRAPHY
Effects of pressure on ion exchange and ion pairing chromatography
N78-18154
LIQUID COOLING
A personal cooling system for helicopter pilots
[AD-A047649] N78-18767
LIQUID CRYSTALS
Liquid crystal airborne display
[AD-A048198] N78-18062
LIQUID INJECTION
Use of fluid injection to regulate the combustion chamber pressure for unstably burning solid propellant combustion
[DLR-IB-456-77/4] N78-18124
LIQUID METALS
Thermophysical measurements on liquid metals above 4000 K
[UCRL-78782] N78-18200
LIQUID PHASES
Magnetic LPE crystalline films for small bubble diameter cylindrical-domain memory applications
[AD-A048197] N78-18957
LIQUID PROPELLANT ROCKET ENGINES
Tripropellant engine study
[NASA-CR-150562] N78-18119
LIQUID ROCKET PROPELLANTS
Tripropellant engine study
[NASA-CR-150562] N78-18119
LIQUID-GAS MIXTURES
Studies of gas injection into a liquid stream
[OUEL-1216/77] N78-18373
LIQUID-VAPOR INTERFACES
Methods for the calculation of the value of the logarithm of the activity coefficient of a component at infinite dilution from binary vapour-liquid data
[NPL-CHEM-74] N78-18165
LITHERGOL ROCKET ENGINES
Lithergol dual propulsion for cruise missiles
[DLR-IB-76-7] N78-18122
LITHIUM ALLOYS
The density, electrical resistivity and Hall coefficient of Li-B alloys
[AD-A048064] N78-18325
LITHIUM COMPOUNDS
Solid electrolyte battery materials
[AD-A048330] N78-18559
LITHIUM NIOBATES
Large-aperture optical modulator materials. Lead lanthanum zirconate titanate ceramic and lithium niobate crystal show promise as modulator materials for optical transmitters with up to 6-inch apertures
[AD-A048163] N78-18909
LIVER
DNA status in rat liver and spleen following flight on Kosmos-605 satellite
N78-18742
Carbohydrate and lipid content of rat liver tissue following a 22-day space flight
N78-18755
LOAD DISTRIBUTION [FORCES]
The development of fatigue/crack growth analysis loading spectra
N78-18048
LOADS [FORCES]
Fatigue load monitoring
N78-18052
LOGARITHMS
Methods for the calculation of the value of the logarithm of the activity coefficient of a component at infinite dilution from binary vapour-liquid data
[NPL-CHEM-74] N78-18165
LOGIC CIRCUITS
Hardware verification
[AD-A048684] N78-18778
LOGISTICS
Sea nymph pilot LCC model development
[AD-A048109] N78-18278
Total contractor logistics support: A new concept in naval aviation
[AD-A048674] N78-18971
LOGISTICS MANAGEMENT
A study of the energy consequences of alternative transport policies in intercity freight markets
N78-18547
LONG DURATION EXPOSURE FACILITY
An introduction to shuttle/LDEF retrieval operations: The R-bar approach option — orbital mechanics and braking schedule
[NASA-TM-78668] N78-18105
LONGITUDINAL CONTROL
Optimal level controls of high performance aircraft
[DLR-IB-552-77/20] N78-18059
Flight test of stick force stability in attitude-stabilized aircraft
[NLR-MP-77015-U] N78-18080
LONGITUDINAL STABILITY
The application of techniques for predicting STOL aircraft response to wind shear and turbulence during the landing approach
[UTIAS-215] N78-18077
LOOPS
Simulation of transmission electron micrographs for small dislocation loops
N78-18904
LORAN
LORAN automatic vehicle monitoring system, Phase 1. Volume 1: Test results
[PB-274955/4] N78-18034
LORAN C
LORAN automatic vehicle monitoring system, phase 1. Volume 2: Appendices
[PB-274956/2] N78-18039
LOW ASPECT RATIO WINGS
A theoretical investigation of the aerodynamics of low-aspect-ratio wings with partial leading-edge separation
[NASA-CR-145304] N78-17993
LOW COST
Phase 1 of the automated array assembly task of the low cost silicon solar array project
[NASA-CR-155935] N78-18516
LOW DENSITY MATERIALS
Effective thermal conductivity determination for low-density insulating materials
[NASA-TP-1155] N78-18364

LOW LEVEL TURBULENCE
Low-level, atmospheric turbulence model for marine environments
[AD-A047980] N78-18633
LOW NOISE
Ambiguous range study report
[AD-A048612] N78-18033
LOW SPEED
A flight evaluation of a trailing anemometer for low-speed calibrations of airspeed systems on research aircraft
[NASA-TP-1135] N78-18044
LOW TEMPERATURE
Electronic instability and change of crystalline phase in compounds of the V3Si type at low temperature
[NASA-TM-75178] N78-18953
LOW TEMPERATURE PHYSICS
Thermal and electrical transport measurements in single crystal beryllium at low temperatures
N78-18952
LUBRICATING OILS
A review of theories for the fluid dynamic effects of roughness on laminar lubricating films
[AD-A048333] N78-18217
Study on the formation of reaction layers on metal surfaces by using lubricant additives
[DLR-FB-77-31] N78-18222
Positive commandable oiler for satellite bearing lubrication
N78-19035
LUBRICATION
Statistical model for asperity-contact time fraction in elastohydrodynamic lubrication
[NASA-TP-1130] N78-18429
Thermoelastic phenomena in lubricated sliding contact
[AD-A047926] N78-18431
LUMINOUS INTENSITY
Intensity, angular distribution and polarization of spontaneous molecular light scattering
[ESA-TT-438] N78-18298
LUNAR EVOLUTION
Low-speed impact phenomena and orbital resonances in the moon- and planet-building process
[NASA-CR-155310] N78-19016
LUNAR ROCKS
Lunar sample analysis
[NASA-CR-151618] N78-19021
LUNAR SOIL
Apollo 14 coarse fines [4-10 mm] sample location and classification
[NASA-TM-79348] N78-19020
LUNAR SURFACE
Lunar sample analysis
[NASA-CR-151618] N78-19021

M

MACHINE ORIENTED LANGUAGES
The process of question answering
N78-18790
MACHINE-INDEPENDENT PROGRAMS
An introduction to network job control language
[NPL-COM-88] N78-18809
MACROSCOPIC EQUATIONS
Macroscopic description of laser-type matter
[AD-A048442] N78-18422
MAGNESIUM CHLORIDES
Stress corrosion and repassivation behavior of austenitic stainless steels in boiling MgCl2 solution
[ESA-TT-437] N78-18204
MAGNESIUM OXIDES
High durability missile domes
[AD-A048497] N78-18101
MAGNET COILS
Design of superconducting toroidal magnet coils and testing facility in the USA
[CONF-770842-5] N78-18340
MAGNETIC COILS
Magnifying image intensifier
[NASA-CASE-GSC-12010-1] N78-18905
MAGNETIC FIELD CONFIGURATIONS
Magnifying image intensifier
[NASA-CASE-GSC-12010-1] N78-18905
A poloidal divertor model for Tokamak fusion reactors
N78-18924
Alfven instability and micromagnetic islands in a plasma with sheared magnetic fields
[PPPL-1358] N78-18941
MAGNETIC FIELDS
The characteristics of broadband, isotropic electrical field and magnetic field probes
[PB-274457/1] N78-18339
Microwave simulation of laser plasma interactions
[UCRL-13752] N78-18423
A two dimensional MHD model for magnetic field line reconnection in an incompressible and inviscid plasma
N78-18604
Electrolyte content of blood and potassium ion transport in erythrocytes of animals exposed to a steady magnetic field
N78-18727
Effect of superhigh intensity constant magnetic fields on morphological composition of peripheral blood
N78-18749
Theory of surface polaritons in n-InSb in the presence of a DC current and an external DC magnetic field
[AD-A048217] N78-18959
Investigation of magnetic water treatment devices -- - calcium carbonate scale retardation
N78-18987
MAGNETIC FILMS
Magnetic LPE crystalline films for small bubble diameter cylindrical-domain memory applications
[AD-A048197] N78-18957
MAGNETIC MATERIALS
Field equations for micropolar current and a heat conducting magnetically-saturated solid
N78-18239
MAGNETIC SIGNATURES
Geomagnetic data for March 1976 [AE [7] indices and stacked magnetograms]
[PB-275096/6] N78-18614
MAGNETIC SUSPENSION
Magnetic bearing momentum wheels with magnetic gimballing capability for 3-axis active attitude control and energy storage
N78-19031
Development of a satellite flywheel family operating on one active axis magnetic bearings
N78-19043
MAGNETICALLY TRAPPED PARTICLES
Non-stochastic heating of magnetized plasma by electrostatic wave
[IPPJ-314] N78-18930
MAGNETOHYDRODYNAMIC STABILITY
Alfven instability and micromagnetic islands in a plasma with sheared magnetic fields
[PPPL-1358] N78-18941
Survey of linear MHD stability in Tokamak configurations
[COO-2456-46] N78-18942
MAGNETOHYDRODYNAMIC WAVES
Alfven instability and micromagnetic islands in a plasma with sheared magnetic fields
[PPPL-1358] N78-18941
MAGNETOHYDRODYNAMICS
A two dimensional MHD model for magnetic field line reconnection in an incompressible and inviscid plasma
N78-18604
MAGNETOMETERS
Study to develop gradiometer techniques
[AD-A048252] N78-18609
The MJS-77 magnetometer actuator
N78-19034
MAGNETOSPHERE
Report presented to the 20th COSPAR General Assembly
N78-18616
MAGNIFICATION
Magnifying image intensifier
[NASA-CASE-GSC-12010-1] N78-18905
MAINTENANCE
Digital Avionics Information System [DAIS]: Mid-1980's maintenance analysis
[AD-A047886] N78-18063
NBS type 4 RF power meter operation and maintenance
[PB-274456/3] N78-18402
MAN MACHINE SYSTEMS
A comparison of integrated and conventional cockpit warning systems — pilot performance and reaction time in man machine systems
[AD-A048670] N78-18022
On the use of programming knowledge to understand informal process description
[AD-A048153] N78-18802
An introduction to network job control language
[NPL-COM-88] N78-18809
The inference of domain structure from informal process descriptions
[AD-A048154] N78-18825
MANAGEMENT
HUD/PTI Information Systems Improvement Program. An orientation to comprehensive information systems improvement for a local government
[PB-274177/5] N78-18994
MANAGEMENT INFORMATION SYSTEMS
What the next decade is going to bring
[NASA-TM-79361] N78-18976
HUD/PTI Information Systems Improvement Program, Chief Executive's overview
[PB-274207/0] N78-18990
HUD/PTI Information Systems Improvement Program. Planning and management: A methodology guide
[PB-274179/1] N78-18996
MANAGEMENT METHODS
Selecting analytic approaches for decision situations Volume 1. Overview of the methodology
[AD-A047965] N78-18966
Selecting analytic approaches for decision situations Volume 2. Case studies — foreign policy and defense industries
[AD-A047880] N78-18967
Selecting analytic approaches for decision situations Volume 3. Appendices
[AD-A048228] N78-18968
Management strategies in fixed structure models of complex organizations, 2
[AD-A048789] N78-18972
MANAGEMENT PLANNING
Sensors Workshop summary report
[NASA-TM-74978] N78-18498
Software acquisition management guidebook: Verification
[AD-A048577] N78-18807
Joint design-to-cost guide. Life cycle as a design parameter
[AD-A048254] N78-18965
Selecting analytic approaches for decision situations Volume 1. Overview of the methodology
[AD-A047965] N78-18966
Selecting analytic approaches for decision situations Volume 2. Case studies — foreign policy and defense industries
[AD-A047880] N78-18967
Selecting analytic approaches for decision situations Volume 3. Appendices
[AD-A048228] N78-18968
Total contractor logistics support: A new concept in naval aviation
[AD-A048674] N78-18971
Management strategies in fixed structure models of complex organizations, 2
[AD-A048789] N78-18972
Developing an acquisitions system for a university library
[BLL-BLRDR-5351] N78-18983
A survey on the state of research in automated scheduling of urban passenger transportation
[PB-274587/5] N78-19000
Conservation districts and 208 water quality management: Non-point source identification and assessment, selection of best management practices, management agencies, regulatory programs
[PB-274411/8] N78-19001
MANGANESE
Manganese - 1977
[PB-274070/2] N78-18205
MANNED SPACE FLIGHT
Investigation of space perception by the crew of the experimental Soyuz-Apollo mission
N78-18695
MANUALS
Control strategy preparation manual for particulate matter
[PB-274861/4] N78-18598
MAPPING
Cartographic compilation study. Volume 1. System requirements and design analyses
[AD-A048220] N78-18501
Cartographic compilation study. Volume 2. Design specifications, Advanced Revision and Compilation System [ARCS]
[AD-A048221] N78-18502
Adaptive mapping of mid-latitude ionosphere
[AD-A048116] N78-18607
MAPS
Electron beam recorder applications study
[AD-A048666] N78-18399
MARAGING STEELS
The effect of microstructure and strength on the fracture toughness of an 18 Ni, 300 grade maraging steel
N78-18174
MARINE BIOLOGY
Environmental assessment of the Alaskan continental shelf. Northeast gulf of Alaska
[PB-275212/9] N78-18619
MARINE ENVIRONMENTS
A comparative study of the coastal marine aerosol
[AD-A048673] N78-18576
Low-level, atmospheric turbulence model for marine environments
[AD-A047980] N78-18633
MARINE METEOROLOGY
A comparative study of the coastal marine aerosol
[AD-A048673] N78-18576
Guide to marine meteorological services
[WMO-471] N78-18645
MARINE RESOURCES
International transfer of marine technology, a three-volume study — social, political and economic factors
[PB-275353/1] N78-18986
MARINER JUPITER-SATURN FLYBY
The MJS-77 magnetometer actuator
N78-19034
MARKING
Accessing numeric data via flags and tags: A final report on a real world experiment
[NASA-TM-79326] N78-18975

MARKOV PROCESSES
A review of DOAE papers on mathematical models of attrition
[AD-A048609] N78-18861
MARTENSITE
Research on martensitic transformations in iron alloys
[AD-A047940] N78-18189
MASS
Rocket stage mass model for performance prediction
[DLR-IB-456-75/8] N78-18115
Program listing of an analytic mass model for chemical rocket stages
[DLR-IB-456-76/2] N78-18125
MASS FLOW
Mathematical elaboration of the double sliding, free rotating model
N78-18236
On the prediction of mass flow rates of propane
N78-18350
MASSACHUSETTS
Massachusetts coastal zone management program, volume 1
[PB-274031/4] N78-18667
MATERIALS HANDLING
A system for delivering SiCl4 to a chemical reactor
[NASA-CASE-NPO-14383-1] N78-18253
Complex materials handling and assembly systems
[PB-274539/6] N78-18434
Complex materials handling and assembly systems
[PB-274540/4] N78-18435
MATHEMATICAL LOGIC
Disclination kinematics
N78-18241
MATHEMATICAL MODELS
A computational model for three-dimensional incompressible small cross flow wall jets
[AD-A048450] N78-18008
Split-operator, finite difference solution for axisymmetric laminar jet diffusion flames
[SAND-77-8502] N78-18079
Rocket stage mass model for performance prediction
[DLR-IB-456-75/8] N78-18115
Analytical model of a single axis attitude roll control system
[SAND-77-8256] N78-18164
Model laws for granular media and powders with a special view to silo models
N78-18235
Mathematical elaboration of the double sliding, free rotating model
N78-18236
On the non-standard formulation of mechanics
N78-18237
Evaluation of a laboratory test model annular momentum control device
[NASA-TP-1142] N78-18252
On the planarity of hypergraphs
[AD-A048051] N78-18318
Inviscid fluid models, based on rolled-up vortex sheets, for three-dimensional separation at high Reynolds number
N78-18384
Mathematical model for rubber hysteresis
N78-18450
Improvements to single-source model. Volume 3. Further analysis of modeling results
[PB-274527/1] N78-18593
Near-surface air parcel trajectories: St. Louis, 1975
[PB-274368/0] N78-18599
Reflection and refraction of solitary waves: A numerical investigation
N78-18659
A two-scale scattering model with application to the JONSWAP '75 aircraft microwave scatterometer experiment
[NASA-CR-2919] N78-18662
A new model of nerve action potential and the existence of a pulse solution
N78-18676
Partial differential rate equations for a bilevel absorber
[AD-A048601] N78-18854
A review of DOAE papers on mathematical models of attrition
[AD-A048609] N78-18861
Application of sensitivity theory and optimization techniques to models of large scale systems
N78-18864
Concept and use of models, part 1 and part 2
[AD-A048594] N78-18865
A poloidal divertor model for Tokamak fusion reactors
N78-18924
Phase transitions and critical phenomena: Universality and global multicritical phase diagrams from position-space renormalization-group studies
N78-18945
Photopolarimetry of scattering surfaces and their interpretation by computer model
[NASA-CR-155305] N78-19013
MATHEMATICAL PROGRAMMING
An evaluation of mathematical programming and minicomputers
[AD-A048299] N78-18805
Time-dependent mathematical programs
[AD-A048428] N78-18852
MATRICES [CIRCUITS]
Liquid crystal airborne display
[AD-A048198] N78-18062
Synthesis of linear passive time-variable transmission matrices
N78-18305
MATRICES [MATHEMATICS]
Matrix isolation Fourier transform infrared spectroscopy of polycyclic aromatic hydrocarbons
N78-18146
Calculation of the per-unit length capacitance matrix for shielded insulated wires
[AD-A048174] N78-18324
Momentum distributions and one-body density matrices of the quantum fluids
N78-18348
Hypothesis testing for the parameters of a covariance matrix having linear structure
N78-18829
Direct solutions of large, sparse linear systems
[AD-A047776] N78-18843
An algorithmic approach for reducing kinematically similar differential systems
[AD-A047781] N78-18845
Comparison between phase shift derived and exactly calculated nucleon-nucleon interaction matrix elements
N78-18893
A practical Hadamard spectrometer for astronomical application
N78-19007
MATRIX METHODS
Graphical evaluation of relativistic matrix elements
[NASA-CR-155774] N78-18884
MEASURING INSTRUMENTS
Evaluation of postural mechanisms under dynamic conditions
[NASA-CR-151638] N78-18700
MECHANICAL DEVICES
The 11th Aerospace Mechanisms Symposium
[NASA-TM-79350] N78-19026
Design and development of the Space Shuttle tail service masts
N78-19027
Scanning and focusing mechanisms of METEOSAT radiometer
N78-19028
Magnetometer deployment mechanism for Pioneer Venus
N78-19029
Fly-away restraint pin mechanism for the Army's PATRIOT missile system
N78-19030
Magnetic bearing momentum wheels with magnetic gimballing capability for 3-axis active attitude control and energy storage
N78-19031
An application of interactive computer graphics technology to the design of dispersal mechanisms
N78-19032
Cartridge firing device designed for attachment, release and ejection of a satellite
N78-19033
The MJS-77 magnetometer actuator
N78-19034
Positive commandable oiler for satellite bearing lubrication
N78-19035
Docking and retrieval mechanism
N78-19036
Torque-while-turnaround scan mirror assembly
N78-19037
Wear-resistant ball bearings for space applications
N78-19038
An active nutation damper for spacecraft
N78-19039
The GEOS-20 m Cable Boom Mechanism
N78-19040
A low cost high temperature sun tracking solar energy collector
N78-19041
Two-dimensional oscillating airfoil test apparatus
N78-19042
Development of a satellite flywheel family operating on one active axis magnetic bearings
N78-19043
The conception, birth, and growth of a missile umbilical system
N78-19044
Focus drive mechanism for the IUE scientific instrument
N78-19045
Design and development of a solar array drive — a direct drive solar array pointing mechanism
N78-19046
MECHANICAL DRIVES
The 11th Aerospace Mechanisms Symposium
[NASA-TM-79350] N78-19026
Focus drive mechanism for the IUE scientific instrument
N78-19045
Design and development of a solar array drive — a direct drive solar array pointing mechanism
N78-19046
MECHANICAL ENGINEERING
The 11th Aerospace Mechanisms Symposium
[NASA-TM-79350] N78-19026
MECHANICAL OSCILLATORS
Torque-while-turnaround scan mirror assembly
N78-19037
MECHANICAL PROPERTIES
The chemical, mechanical, and implant properties of glass-coated alumina
N78-18130
MECHANICS [PHYSICS]
Mechanisms and kinetics of binary alkali silicate glass corrosion
N78-18207
Archives of Mechanics, volume 29, issue 5
N78-18240
MEDICAL EQUIPMENT
Design of a blood-freezing system for leukemia research
[NASA-TP-1165] N78-18673
Design of a pyro-electric vidicon camera for medical thermography
[THT-TM-77-009] N78-18707
MELTING
Temperature dependence of jet swell and material functions in polymer melt systems
N78-18206
MEMBRANES
Anion permselective membrane
[NASA-CR-135316] N78-18515
MERCURY AMALGAMS
Amalgam stabilization by selective interfacial amalgamation — polyacrylate dental cavity linings
N78-18178
MESON RESONANCES
Narrowlogy - phenomenology of low energy narrow resonance
[PM/77/6] N78-18890
METABOLISM
Distinctions of fluid and electrolyte metabolism and renal function in crew members of the first Salyut-4 expedition
N78-18685
Morphological manifestations of functional changes in the hypothalamo-hypophyseal neurosecretory system and rat kidneys under the influence of space flight factors
N78-18690
METAL COATINGS
Applications of quantum electronics. Part 2: The metal coating of optical fibres
[OUEL-1184/77-PT-2] N78-18918
METAL COMPOUNDS
Analogies among active sites of coordinativelyunsaturated transition-metal complexes, surfaces and supported catalysts
[AD-A048289] N78-18197
METAL CRYSTALS
Coupling of dissipative mechanisms of viscoplastic flow
N78-18238
Theoretical studies of cyclic straining in polycrystalline metal plasticity
N78-18454
METAL DRAWING
Calculations of stresses in wall ironing
[OUEL-1187/77] N78-18469
METAL FATIGUE
Analysis of the usefulness of diffusion equations for the description of dislocation mobility and related phenomena
N78-18232
METAL IONS
The structure of complexes of mono- and polynucleotides with metal ions of the first transition group. Part 1: Crystallographic studies
[ISS-R-76/7-PT-1] N78-18891
The structure of complexes of mono- and polynucleotides with metal ions of the first transition group. Part 2: Nuclear magnetic resonance studies
[ISS-R-76/8-PT-2] N78-18892
METAL MATRIX COMPOSITES
Fuselage structure using advanced technology metal matrix fiber reinforced composites
[NASA-CASE-LAR-11688-1] N78-18045
A theory for longitudinal wave propagation in a composite rod: A model for linear elastodynamic behavior of composite penetrators
[AD-A048552] N78-18285
METAL OXIDE SEMICONDUCTORS
Inversion layer carrier distribution and carrier effective mobility in metal-oxide-semiconductor devices
N78-18948
METAL OXIDES
Study of the physics of insulating films as related to the reliability of metal-oxide semiconductor devices
[AD-A048483] N78-18328

Chemical laser potential of selected group 4-A metal oxides
[AD-A048779] N78-18419
METAL SURFACES
Study on the formation of reaction layers on metal surfaces by using lubricant additives
[DLR-FB-77-31] N78-18222
METALLURGY
Manganese - 1977
[PB-274070/2] N78-18205
METALS
Initial and final state effects in Auger and X-ray photoelectron spectroscopies
N78-18144
Investigation into the effect of dissimilar metal coupling, potential, and processing on the mode and distribution of galvanic corrosion attack on 5086 aluminum alloy in synthetic seawater
[AD-A048527] N78-18190
Biological significance of some metals as air pollutants. Part 1, lead
[PB-274055/3] N78-18585
METASTABLE STATE
The influence of thermomechanical processing on the microstructure of metastable beta-Ti alloys
[AD-A048771] N78-18194
Some observations on the structure of Ti-11.5Mo-6Zr-4.5Sn [beta 3] as affected by processing history
[AD-A048772] N78-18195
The relationship between the microstructure and age hardening response in the metastable deta titanium alloy Ti-11.5Mo6Zr-4.5Sn [beta 3]
[AD-A048773] N78-18196
METEOROLOGICAL PARAMETERS
The Nimbus 6 data catalog. Volume 9: Data orbits 6803 through 7619, 1 November - 31 December 1976
N78-18631
Oceanographic station data collected aboard R/V Melville during FDRAKE 75
[PB-274442/3] N78-18668
METEOROLOGICAL RADAR
Real-time computer techniques in the detection and analysis of severe storms from digital radar data
N78-18622
Application of Doppler weather radar to turbulence measurements which affect aircraft
[AD-A048603] N78-18641
METEOROLOGICAL SATELLITES
Forecasting daily rainfall amount for a single station using satellite photographs
[TN-21] N78-18621
METEOROLOGICAL SERVICES
Guide to marine meteorological services
[WMO-471] N78-18645
Estimating the energy conservation potential of ventilation control through weather data analysis
[PB-273949/8] N78-18655
METEOROLOGY
The relation of oxidant levels to precursor emissions and meteorological features. Volume 1: Analysis and findings
[PB-275001/6] N78-18618
Tropical cyclone research by data compositing
[AD-A048168] N78-18635
Meteorological satellite observations and Army operations
[AD-A048157] N78-18636
Bibliography of statistical and meteorological methodology in weather modification, II
[AD-A048686] N78-18638
White Sands Missile Range climate calendar
[AD-A048305] N78-18639
The 14818C lance missile number 3292, round number 298 APT, 24 August 1977
[AD-A048321] N78-18640
Meteorological data report. 12828F Lance missile no. 2215, round no. 302 RSL, 6 October 1977
[AD-A048273] N78-18642
Meteorological data report. 14821A Lance missile no. 3296, round no. 303 APT, 10 November 1977
[AD-A048272] N78-18643
Compendium of training facilities in environmental problems related to meteorology and operational hydrology
[WMO-489] N78-18644
Compendium of meteorological training facilities, fifth edition
[WMO-240] N78-18649
A dual Doppler radar study of the urban boundary layer: A summary of METROMEX results
[PB-275346/5] N78-18656
METEOSAT SATELLITE
Scanning and focusing mechanisms of METEOSAT radiometer
N78-19028
METHYLHYDRAZINE
A study for hypergolic vapor sensor development
[NASA-CR-155770] N78-18224
METRIC SPACE
A study of remote points of metric spaces
N78-18867
MICHELSON INTERFEROMETERS
Interferometer mirror tilt correcting system
[NASA-CASE-NPO-13687-1] N78-18391
MICROBIOLOGY
Investigation of concomitant microflora in prolonged substrate-free cultivation of beet plants
N78-18729
MICROELECTRONICS
High speed micro signal processor study
[AD-A047997] N78-18322
MICROMETEOROIDS
Semiconductor projectile impact detector
[NASA-CASE-MFS-23008-1] N78-18390
MICROPOLAR FLUIDS
Archives of mechanics, volume 29, issue 4
N78-18231
Theory of disclinations in elastic Cosserat media
N78-18234
The existence of instationary flows in incompressible micropolar fluids
N78-18249
MICROPROCESSORS
Modular multicomputer systems with mini- and microprocessors. Military applicability and research activities
[FFM-246] N78-18816
Problems in designing a high-speed linear data bus for a multimicroprocessor system
[NPL-COM-89] N78-18817
Augmentation of a text retrieval system with an intelligent graphics terminal
[NPL-COM-86] N78-18980
MICROSTRIP TRANSMISSION LINES
Design of microstrip disk antenna arrays
[NASA-TM-78631] N78-18263
MICROSTRUCTURE
The effect of microstructure and strength on the fracture toughness of an 18 Ni, 300 grade maraging steel
N78-18174
Research on martensitic transformations in iron alloys
[AD-A047940] N78-18189
The relationship between the microstructure and age hardening response in the metastable deta titanium alloy Ti-11.5Mo6Zr-4.5Sn [beta 3]
[AD-A048773] N78-18196
Microstructure stability of high temperature cast and forged alloys on Ni basis — gas turbine materials
N78-18201
Influence of microstructure on fatigue crack propagation rate of aluminium alloys
[ESA-TT-418] N78-18203
MICROWAVE AMPLIFIERS
Model 8726H traveling wave tube
[AD-A048222] N78-18316
MICROWAVE CIRCUITS
Computer aided analysis of microwave electronic circuits in the frequency domain [ESAMEC]
[ESA-TT-441] N78-18341
MICROWAVE EQUIPMENT
Microwave dichroic plate
[NASA-CASE-GSC-12171-1] N78-18313
Microstrip reflectarray antenna program
[AD-A048480] N78-18337
MICROWAVE FREQUENCIES
Microwave techniques for nondestructive evaluation of ceramics
[AD-A048582] N78-18443
MICROWAVE LANDING SYSTEMS
Benefits of MLS guidance for curved approaches. Volume 2: Operational benefits for New York Airports
[PB-274585/9] N78-18037
MICROWAVE OSCILLATORS
A production engineering measure for two L-band solid state microwave frequency sources
[AD-A047903] N78-18315
MICROWAVE PLASMA PROBES
Microwave simulation of laser plasma interactions
[UCRL-13752] N78-18423
MICROWAVE SCATTERING
A two-scale scattering model with application to the JONSWAP '75 aircraft microwave scatterometer experiment
[NASA-CR-2919] N78-18662
MICROWAVE SENSORS
On the feasibility of monitoring soil moisture using active microwave remote sensing: An experimental evaluation
N78-18477
MICROWAVE TRANSMISSION
Multipath over LOS channels study
[AD-A048175] N78-18271
MIE SCATTERING
Studies in application of discrete ordinates transport methods to light transport calculations: Preparation of Mie theory cross sections in Legendre polynomials
[AD-A048614] N78-18913
MILITARY TECHNOLOGY
Meteorological satellite observations and Army operations
[AD-A048157] N78-18636
Modular multicomputer systems with mini- and microprocessors. Military applicability and research activities
[FFM-246] N78-18816
MINES [EXCAVATIONS]
Preliminary evaluation of sulfur variability in low-sulfur coals from selected mines
[PB-275000/8] N78-18566
MINICOMPUTERS
Application of minicomputers to studies in electroanalytical chemistry
N78-18148
Constraints in the design and implementation of interactive statistical systems for minicomputers
[AD-A048124] N78-18803
An evaluation of mathematical programming and minicomputers
[AD-A048299] N78-18805
Modular multicomputer systems with mini- and microprocessors. Military applicability and research activities
[FFM-246] N78-18816
MINIMAX TECHNIQUE
Component-wise minimax property of Stein's rule
[AD-A048125] N78-18851
On rules based on sample medians for selection of the largest location parameter
[AD-A047948] N78-18860
MIRRORS
Interferometer mirror tilt correcting system
[NASA-CASE-NPO-13687-1] N78-18391
Torque-while-turnaround scan mirror assembly
N78-19037
MISSILE COMPONENTS
High durability missile domes
[AD-A048497] N78-18101
MISSILE LAUNCHERS
Test and evaluation for an air-launched guided missile program
[AD-A048675] N78-18100
Meteorological data report. 12828F Lance missile no. 2215, round no. 302 RSL, 6 October 1977
[AD-A048273] N78-18642
MISSILE RANGES
White Sands Missile Range climate calendar
[AD-A048305] N78-18639
MISSILE SYSTEMS
An application of interactive computer graphics technology to the design of dispersal mechanisms
N78-19032
The conception, birth, and growth of a missile umbilical system
N78-19044
MISSILE TESTS
Test and evaluation for an air-launched guided missile program
[AD-A048675] N78-18100
MISSILE TRACKING
The closed form solution of true proportional navigation
[AD-A048008] N78-18031
Segmentation and structure analysis for real-time video target tracking
[AD-A048156] N78-18270
MISSION PLANNING
Post LANDSAT D Advanced Concept Evaluation [PLACE] — with emphasis on mission planning, technological forecasting, and user requirements
[NASA-CR-155769] N78-18499
MIXERS
Variable mixer propulsion cycle
[NASA-CASE-LEW-12917-1] N78-18067
MIXING CIRCUITS
Building block modules: Frequency synthesizer and amplifier-mixer
[AD-A048209] N78-18320
MIXTURES
Analytic solution for the equilibrium composition of a carbon-nitrogen-oxygen gas mixture
[AD-A048597] N78-18161
MODAL RESPONSE
Improvement of modal methods for dynamic response problems of linear elastic structures
[DLR-FB-77-33] N78-18474
MODE [STATISTICS]
Application and comparison of modal perturbation methods and modal correction procedures exemplified by a swept wing with two external stores
[DLR-FB-77-21] N78-18014
MODELS
Communication system performance model for VHF and higher frequencies
[PB-274458/9] N78-18299
MODULES
Four versatile MIDAS compatible modules
[PB-274453/0] N78-18785
MODULUS OF ELASTICITY
Investigation of processing microstructures and properties of oxide dispersion strengthened cobalt alloy extruced shapes
[AD-A048593] N78-18198
MOISTURE CONTENT
A feasibility study for the development of a nuclear moisture density measurement system for marine use
[AD-A048665] N78-18663
MOLECULAR BEAMS
Molecular beam studies on multiphoton dissociation of polyatomic molecules
[LBL-6275] N78-18888

MOLECULAR BIOLOGY
High sensitivity Fourier transform NMR. Intermolecular interactions between environmental toxic substances and biological macromolecules
[PB-274011/6] N78-18675
Synthesis and biological screening of novel hybrid fluorocarbon hydrocarbon compounds for use as artificial blood substitutes
[NASA-CR-155781] N78-18702

MOLECULAR COLLISIONS
Formal and computational studies of molecular collision dynamics
N78-18880

MOLECULAR EXCITATION
Electron scattering from vibrationally excited nitrogen
N78-18881

MOLECULAR GASES
Two-photon absorption of molecular crystals and gas — napthalene, biphenyl, and benzene
N78-18950

MOLECULAR INTERACTIONS
Intensity, angular distribution and polarization of spontaneous molecular light scattering
[ESA-TT-438] N78-18298

MOLECULAR RELAXATION
Initial and final state effects in Auger and X-ray photoelectron spectroscopies
N78-18144
Formal and computational studies of molecular collision dynamics
N78-18880
Exchange and relaxation effects in low-energy radiationless transitions
[NASA-TM-79383] N78-18882
Relaxation of the bending mode of carbon dioxide by vibration to rotation and vibration to vibration energy transfer
N78-18951

MOLECULAR STRUCTURE
Structure and intramolecular interconversions of some organometallic complexes
N78-18170
Reaction kinetics and structure of enzyme macromolecules subjected to hydrodynamic shearing forces: Enzyme mechanochemistry
N78-18210
The treatment of cellulose by high pressure discharge — molecular structure modifications
N78-18221

MOLECULES
Collision studies of gaseous molecular lasers
[AD-A048010] N78-18413

MOLYBDENUM
Some observations on the structure of Ti-11.5Mo-6Zr-4.5Sn [beta 3] as affected by processing history
[AD-A048772] N78-18195

MOMENTUM
Momentum distributions and one-body density matrices of the quantum fluids
N78-18348
Optimal control of a large space telescope using an annular momentum control device
N78-18428

MOMENTUM TRANSFER
Neutron star crust-neutron superfluid frictional forces
N78-19010

MONITORS
Verifying concurrent programs with shared data classes
[AD-A048637] N78-18808

MONOPULSE ANTENNAS
The effects of multipath reception on monopulse systems
[DLR-IB-551-77/7] N78-18292

MONOPULSE RADAR
The effects of multipath reception on monopulse systems
[DLR-IB-551-77/7] N78-18292

MONOTONE FUNCTIONS
Approximation of a completely monotone function
[AD-A048249] N78-18842

MONTANA
Use of LANDSAT-1 data for the detection and mapping of saline seeps in Montana
[E78-10074] N78-18483

MONTE CARLO METHOD
The Monte Carlo simulation of the Ladon photon beam facility — backward Compton scattering of argon laser light with storage ring electrons
[ISS-P-76/10] N78-18425
Forward Monte Carlo method for the solution of time-dependent heat conduction equation
[AD-A048268] N78-18858
A Monte Carlo method of solving heat conduction problems
N78-18962

MONTH
Practical use of transitional rules for forecasting the monthly mean temperature at De Bilt
[KNMI-V-290] N78-18648

MORPHOLOGY
Morphological studies of rising equatorial spread F bubbles
[AD-A048752] N78-18612
Effect of superhigh intensity constant magnetic fields on morphological composition of peripheral blood
N78-18749

MOSSBAUER EFFECT
A computer program for analyzing unresolved Mossbauer hyperfine spectra
[NASA-TM-78633] N78-18796

MOTION SICKNESS
Cardiovascular reactions to orthostatic tests and human resistance to vestibular stimuli
N78-18724

MOTION STABILITY
The nonlinear response and stability of rotating shells
N78-18457

MOTOR VEHICLES
Shift schedules for emissions and fuel economy testing
[PB-274865/5] N78-18594
State-of-the-art assessment of electric vehicles and hybrid vehicles
[NASA-TM-73756] N78-18988

MOUNTING
Four-point mounting configuration for resonators subjected to severe environments
[AD-A048069] N78-18326
Attaching of strain gages to substrates
[NASA-CASE-FRC-10093-1] N78-18393

MOVING TARGET INDICATORS
An electro optical MTI system for the detection of artificial satellites [the NITH finder]
[AD-A048055] N78-18099
Test and evaluation of the Moving Target Detector [MTD] radar
[AD-A04788] N78-18260

MRCA AIRCRAFT
The philosophy adopted for the flight testing of the Panavia Tornado avionics system in Hack aircraft
N78-18060

MULTIPATH TRANSMISSION
Multipath over LOS channels study
[AD-A048175] N78-18271
The effects of multipath reception on monopulse systems
[DLR-IB-551-77/7] N78-18292

MULTIPLEXING
Common module electro optical multiplexer developer
[AD-A048484] N78-18914

MULTIPROCESSING (COMPUTERS)
Efficient multiple processor coordination
[AD-A048195] N78-18775

MULTISPECTRAL BAND SCANNERS
Torque-while-turnaround scan mirror assembly
N78-19037

MULTIVARIATE STATISTICAL ANALYSIS
Multivariate analysis of atmospheric particulate composition and computer-controlled interference correction for ion-selective electrode measurements in a flowing stream
N78-18569
Hypothesis testing for the parameters of a covariance matrix having linear structure
N78-18829
Regression estimation for multivariate normal distributions
N78-18830
Distribution of sample correlation coefficients
[AD-A048126] N78-18849

MUSCLES
Vestibulotonic reflexes in muscles of the rat hind limb following a flight on Kosmos-605
N78-18745

MUSCULOSKELETAL SYSTEM
Lactate dehydrogenase isozymes of rat skeletal muscles following a space flight and with hypokinesia
N78-18689

MYOELECTRIC POTENTIALS
A new model of nerve action potential and the existence of a pulse solution
N78-18676

N

N-TYPE SEMICONDUCTORS
Theory of bound states associated with n-type inversion layers on silicon
[AD-A048216] N78-18960

NACELLES
Parametric transonic evaluation of type A VSTOL nacelle drag
[AD-A048110] N78-18002
Integrated gas turbine engine-nacelle
[NASA-CASE-LEW-12389-2] N78-18066

NAPHTHALENE
Two-photon absorption of molecular crystals and gas — napthalene, biphenyl, and benzene
N78-18950

NASA PROGRAMS
Ion Propulsion Module [IPM] technology readiness assessment: 1985 Halley's Comet rendezvous mission
[NASA-CR-155308] N78-18120

NASTRAN
The effects of external stores on the flutter of a non-uniform cantilever
[AD-A048360] N78-18078
NASTRAN stress recovery package
[AD-A048744] N78-18467

NATIONAL SEVERE STORMS PROJECT
National Severe Storms Forecast Center
[NASA-CR-150547] N78-18625

NATURAL GAS
Proposed increase in oil and gas leasing on the outer continental shelf, volume 1
[PB-273700/5] N78-18506
Proposed increase in oil and gas leasing on the outer continental shelf, volume 2
[PB-273701/3] N78-18507
Proposed increase in oil and gas leasing on the outer continental shelf, volume 3
[PB-273702/1] N78-18508

NAVIER-STOKES EQUATION
Forebody and afterbody solutions of the Navier-Stokes equations for supersonic flow over blunt bodies in a generalized orthogonal coordinate system
[NASA-TP-1075] N78-18362
Numerical solution of viscous-inviscid interaction problems in two-dimensional compressible flows based on the Navier-Stokes equations
N78-18378

NAVIGATION
A location and navigation method with traveling isophases
[DLR-IB-551-77/4] N78-18035

NAVIGATION AIDS
Flight test results of the strapdown hexad inertial reference unit [SIRU]. Volume 2: Test report
[NASA-TM-73223] N78-18025
Performance characteristics of an attitude velocity acceleration and rate unit [NIS-210-24]
[AD-A048204] N78-18029

NAVIGATORS
Investigation of personality traits of pilots and navigators
N78-18753

NEODYMIUM LASERS
Manufacturing methods and technology engineering for neodymium doped YAG laser rods
[AD-A048662] N78-18416

NERVES
A new model of nerve action potential and the existence of a pulse solution
N78-18676
Nerve form and function: Some cellular aspects of action potential initiation and propagation
N78-18698

NETHERLANDS
A network of lightning counters in the Netherlands
[KNMI-WR-77-6] N78-18647

NETWORK ANALYSIS
Computer aided analysis of microwave electronic circuits in the frequency domain [ESAMEC]
[ESA-TT-441] N78-18341
EDP network analysis for electronics in nuclear radiation environment
[BMVG-FBWT-77-13] N78-18899

NETWORKS
Simulation of the 10-node data communication network operating with link speeds of 9.6 Kb/s
[NPL-COM-87] N78-18297
An introduction to network job control language
[NPL-COM-88] N78-18809

NEUROLOGY
Some psychoneurological requirements in assessing inflight functional state of cosmonauts
N78-18721

NEURONS
Cytochemical studies of proteins and RNA in individual spinal cord motoneurons and spinal ganglia neurons of rats following a space flight
N78-18744

NEUTRON SCATTERING
A neutron scattering study of monolayer nitrogen films
N78-18944

NEUTRON SOURCES
Subsonic gas target 14 MeV neutron generator
N78-18896

NEUTRON STARS
Neutron star crust-neutron superfluid frictional forces
N78-19010

NEW YORK
Benefits of MLS guidance for curved approaches. Volume 2: Operational benefits for New York Airports
[PB-274585/9] N78-18037

NEWTON
Forces in material Space
N78-18246

NICKEL
Directionally solidified eutectic gamma-gamma nickel-base superalloys
[NASA-CASE-LEW-12905-1] N78-18183

NICKEL ALLOYS
Microstructure stability of high temperature cast and forged alloys on Ni basis — gas turbine materials
N78-18201
NPL 7 creep damage in Ni-Cr base alloys
[NPL-DMA-246] N78-18202
NIMBUS 6 SATELLITE
The Nimbus 6 data catalog. Volume 9: Data orbits 6803 through 7619, 1 November - 31 December 1976
N78-18631
NIOBIUM
Electromigration of hydrogen and deuterium in vanadium, niobium and tantalum
N78-18177
On the oxidation of niobium in pure hydrogen atmospheres
[AD-A047963] N78-18185
NIOBIUM ALLOYS
Hydrogen embrittlement of niobium 3: High temperature behavior
[AD-A047957] N78-18187
NITRIC ACID
Development of an unconventional approach to nitrification-dentrification
[PB-274398/7] N78-19003
NITRIDES
Solid electrolyte battery materials
[AD-A048330] N78-18559
NITRITES
Development of an unconventional approach to nitrification-dentrification
[PB-274398/7] N78-19003
NITROGEN
Electron scattering from vibrationally excited nitrogen
N78-18881
A neutron scattering study of monolayer nitrogen films
N78-18944
Thermodynamic properties of U[C,N] solid solutions and derived relationships among Thermodynamic excess properties
N78-18963
NITROGEN DIOXIDE
A study for hypergolic vapor sensor development
[NASA-CR-155770] N78-18224
NITROGEN OXIDES
An experimental determination of the history of formation of the cylinder averaged oxides of nitrogen in diesel combustion
N78-18143
NITROGLYCERIN
Investigations of rocket propellants using tracers. Life testing of plastic propellant gases
[BMVG-FBWT-77-14] N78-18228
NOISE MEASUREMENT
Investigation of ground reflection and impedance from flyover noise measurements
[NASA-CR-145302] N78-18874
NOISE TOLERANCE
Exposure to ultrasonic noise in the Canadian forces
[AD-A048115] N78-18876
NOMENCLATURES
Polarized light: Definitions and nomenclature
[NPL-MOM-25] N78-18921
NONDESTRUCTIVE TESTS
Effect of hydraulic fluid [MIL-H-83282] on selected commercial O-ring compounds
[NASA-TM-78154] N78-18213
Microwave techniques for nondestructive evaluation of ceramics
[AD-A048582] N78-18443
Nondestructive inspection of steel, phase I
[PB-274495/1] N78-18445
NONLINEAR EQUATIONS
A new computational method for constrained nonlinear programming
N78-18793
Quasi-Newton Methods
[NASA-CR-151637] N78-18871
A perturbation expansion for the nonlinear Schrodinger equation with application to the influence of nonlinear Landau damping
[IPPJ-315] N78-18931
Modulated langmuir waves and nonlinear Landau damping — Schroedinger equation
[IPPJ-319] N78-18935
NONLINEAR PROGRAMMING
A new computational method for constrained nonlinear programming
N78-18793
NONLINEAR SYSTEMS
Space-time evolution of nonlinear three-wave interactions
N78-18257
Electrooptic phenomena and devices in gases
[AD-A048328] N78-18910
A note on the dynamic correlation coefficient
[AD-A047654] N78-18985
NONUNIFORM PLASMAS
Soliton and generation of cloud in nonlinear dispersive media with weak dissipation
[IPPJ-312] N78-18928
Alfven instability and micromagnetic islands in a plasma with sheared magnetic fields
[PPPL-1358] N78-18941
NORMAL DENSITY FUNCTIONS
Distribution of sample correlation coefficients
[AD-A048126] N78-18849
Component-wise minimax property of Stein's rule
[AD-A048125] N78-18851
NORMALIZING (STATISTICS)
Phase transitions and critical phenomena: Universality and global multicritical phase diagrams from position-space renormalization-group studies
N78-18945
NORTH DAKOTA
A maximal chromatic expansion method of mapping multichannel imagery into color space — North Dakota
[E78-10075] N78-18484
NOSE CONES
A procedure for the determination of the effect of fuselage nose bluntness on the wave drag of supersonic cruise aircraft
[NASA-CR-145306] N78-17994
NOTCH TESTS
Biaxial testing of graphite/epoxy composites containing stress concentrations, part 2
[AD-A048659] N78-18140
Estimating fatigue crack initiation and propagation lives in notched plates under variable loading histories
N78-18451
NOTCHES
Plane-strain general yielding of a pressurised cylindrical shell containing a long part-through notch
[OUEL-1199/77] N78-18470
The plane-strain general yielding of notched members due to combined axial force and bending. Volume 1: Wedge-shaped notches with large flank angles
[OUEL-1206/77-VOL-1] N78-18471
The plane-strain general yielding of notched members due to combined axial force and bending. Volume 2: Deep circular notches
[OUEL-1210/77-VOL-2] N78-18473
NOZZLE DESIGN
F-15/nonaxisymmetric nozzle system integration study support program
[NASA-CR-135252] N78-18070
NUCLEAR FUELS
Technical and scientific aspects of sanitary and safety problems in nuclear energy production
[ISS-P-76/9] N78-18706
An analysis of the technical status of high level radioactive waste and spent fuel management systems
[NASA-CR-155313] N78-18897
NUCLEAR FUSION
Intense focussed ion beams and their interaction with matter
[AD-A048753] N78-18887
NUCLEAR MAGNETIC RESONANCE
Structure elucidation by nuclear magnetic resonance spectroscopy — bisbenzylisoquinoline alkaloids
N78-18145
High sensitivity Fourier transform NMR. Intermolecular interactions between environmental toxic substances and biological macromolecules
[PB-274011/6] N78-18675
The structure of complexes of mono- and polynucleotides with metal ions of the first transition group. Part 2: Nuclear magnetic resonance studies
[ISS-R-76/8-PT-2] N78-18892
NUCLEAR MODELS
The two level atom of quantum optics
N78-18902
NUCLEAR PHYSICS
Interactions of high-energy particles and Atomic Nuclei with Nuclei, chapter 7 thru 11
[AD-A048311] N78-18885
NUCLEAR POTENTIAL
A feasibility study for the development of a nuclear moisture density measurement system for marine use
[AD-A048665] N78-18663
NUCLEAR POWER PLANTS
Technical and scientific aspects of sanitary and safety problems in nuclear energy production
[ISS-P-76/9] N78-18706
NUCLEAR RADIATION
EDP network analysis for electronics in nuclear radiation environment
[BMVG-FBWT-77-13] N78-18899
NUCLEAR REACTIONS
Interactions of high-energy particles and Atomic Nuclei with Nuclei, chapter 7 thru 11
[AD-A048311] N78-18885
Atomic reactions in very high temperature plasmas
[CONF-770721-1] N78-18937
NUCLEAR REACTORS
Survey of linear MHD stability in Tokamak configurations
[COO-2456-46] N78-18942
NUCLEON-NUCLEON INTERACTIONS
Comparison between phase shift derived and exactly calculated nucleon-nucleon interaction matrix elements
N78-18893
NUCLEOTIDES
The structure of complexes of mono- and polynucleotides with metal ions of the first transition group. Part 1: Crystallographic studies
[ISS-R-76/7-PT-1] N78-18891
The structure of complexes of mono- and polynucleotides with metal ions of the first transition group. Part 2: Nuclear magnetic resonance studies
[ISS-R-76/8-PT-2] N78-18892
NUMBER THEORY
On the distribution of the greatest common divisor
[AD-A048791] N78-18853
NUMERICAL ANALYSIS
A theoretical investigation of the aerodynamics of low-aspect-ratio wings with partial leading-edge separation
[NASA-CR-145304] N78-17993
Compressor and fan wake characteristics
[NASA-CR-155766] N78-17995
Analytical study of a free-wing/free-trimmer concept — for gust alleviation and high lift
[NASA-CR-2946] N78-18000
A numerical investigation of confined turbulent shear flows
N78-18356
Numerical solution of viscous-inviscid interaction problems in two-dimensional compressible flows based on the Navier-Stokes equations
N78-18378
Viscid-inviscid interaction methods for two-dimensional flows, including separation and shock waves
N78-18379
Prediction of unsteady separated flows on oscillating airfoils
N78-18387
Status and future prospects of using numerical methods to study complex flows at high Reynolds numbers
N78-18388
Systems for the determination of polar motion
[PB-274698/0] N78-18617
Numerical methods for the statistical analysis of random processes by means of computers
[NASA-TT-F-17159] N78-18795
Soliton and generation of cloud in nonlinear dispersive media with weak dissipation
[IPPJ-312] N78-18928
NUMERICAL FLOW VISUALIZATION
Status and future prospects of using numerical methods to study complex flows at high Reynolds numbers
N78-18388
NUMERICAL INTEGRATION
A generalized computer program for primitive-equation models
[AD-A048481] N78-18613
Boltzmann equation integration in thermionic converter conditions. Part 2: Terms in Boltzmann equation
[PPPL-1346-PT-2] N78-18939
NUMERICAL WEATHER FORECASTING
Survey: National Meteorological Center
[NASA-CR-150549] N78-18626
NUTATION
An active nutation damper for spacecraft
N78-19039
NYSTAGMUS
Effect of head orientation in the gravity field on severity of caloric nystagmus
N78-18691

O

O RING SEALS
Effect of hydraulic fluid [MIL-H-83282] on selected commercial O-ring compounds
[NASA-TM-78154] N78-18213
Stiffness and damping of elastomeric O-ring bearing mounts
[NASA-CR-135328] N78-18460
OCEAN CURRENTS
Deep sea tides determination from GEOS-3
[NASA-CR-141435] N78-18661
Hydraulic sensor instrumentation of a shore face in a tidal current convergence zone: Cape Henry, Virginia
[PB-275247/5] N78-18671
OCEAN DATA ACQUISITIONS SYSTEMS
Variability of oceanographic conditions at ocean weather stations in the north Atlantic and north Pacific Oceans
[AD-A048730] N78-18665
Oceanographic station data collected aboard R/V Melville during FDRAKE 75
[PB-274442/3] N78-18668
OCEAN SURFACE
A two-scale scattering model with application to the JONSWAP '75 aircraft microwave scatterometer experiment
[NASA-CR-2919] N78-18662

Sea surface temperature determination from infrared radiation. A critical evaluation of the method — coastal water circulation study
[KNMI-WR-77-5] N78-18669
OCEANOGRAPHY
Outline of the survey on the development of earth observation satellites
[NASA-TM-75065] N78-18491
Mixed layer observations during the NORPAX POLE experiment
[AD-A048581] N78-18664
International transfer of marine technology, a three-volume study — social, political and economic factors
[PB-275353/1] N78-18986
OCEANS
Formulation of an advanced computational capability for the prediction of transmission loss in the ocean
[AD-A048262] N78-18875
OIL ADDITIVES
Study on the formation of reaction layers on metal surfaces by using lubricant additives
[DLR-FB-77-31] N78-18222
OMEGA NAVIGATION SYSTEM
Continued investigation of potential application of Omega navigation to civil aviation
[NASA-CR-145307] N78-18028
ONBOARD EQUIPMENT
PSK demodulator. Study report on a demodulator for onboard telemetry decoder
[ESA-CR[P]-968] N78-18114
ONE DIMENSIONAL FLOW
Space-time evolution of nonlinear three-wave interactions
N78-18257
OPERATING TEMPERATURE
The 0.1m subsonic cryogenic tunnel at the University of Southampton
[NASA-CR-145305] N78-18086
OPERATIONAL HAZARDS
Exposure to ultrasonic noise in the Canadian forces
[AD-A048115] N78-18876
OPERATIONAL PROBLEMS
Supporting investigations during testing of the WDL-1 airship in Ghana and Upper Volta — hull temperature, flight data, operational problems
[DLR-IB-536-77/1] N78-18012
OPTICAL COMMUNICATION
Improved quantum receivers for optical communication
[AD-A048688] N78-18280
Design study of a serial digital interface based on fiber optics
[ESA-CR[P]-1008] N78-18916
Search for correlated radio and optical events in long-term studies of extragalactic sources
N78-19018
OPTICAL DATA PROCESSING
Quick-look capability in a European earth resources satellite data network. Volume 2: Appendices 5 to 7
[FU15-4-VOL-2-APP-5-7] N78-18505
Specklegram data reduction using optical and digital techniques
[AD-A048210] N78-18907
OPTICAL EQUIPMENT
Designing holographic optical elements
N78-18389
High-speed fabrication of aspherical surfaces — for optical equipment
N78-18900
OPTICAL MEASUREMENT
The national measurement system for radiometry and photometry
[PB-274643/6] N78-18256
OPTICAL MICROSCOPES
Applications of quantum electronics. Part 1: The scanning optical microscope
[OUEL-1183/77-PT-1] N78-18917
The scanning optical microscope
[OUEL-1220/77] N78-18920
OPTICAL PROPERTIES
Holographic combiners for head-up displays
[AD-A047998] N78-18064
Determination of optical constants of phosphates, sulphates and ammonia and related compounds in the near infrared region
[AD-A048173] N78-18908
Large-aperture optical modulator materials. Lead lanthanum zirconate titanate ceramic and lithium niobate crystal show promise as modulator materials for optical transmitters with up to 6-inch apertures
[AD-A048163] N78-18909
Calculations of the optical properties of laser-induced plasmas in solid bodies — laser weapons target acquisition
[DLR-IB-551-77/6] N78-18943
Optically induced hot electron effects in semiconductors
[AD-A048194] N78-18956
OPTICAL RADAR
Experiences with the ASSESS 2 lidar experiment
[DLR-IB-553-77/6] N78-18296
OPTICAL RESONANCE
Double optical resonance — quantum electrodynamics and emission spectra from atomic excitations
N78-18901
OPTICAL SCANNERS
Applications of quantum electronics. Part 1: The scanning optical microscope
[OUEL-1183/77-PT-1] N78-18917
The scanning optical microscope
[OUEL-1220/77] N78-18920
OPTICAL TRACKING
Segmentation and structure analysis for real-time video target tracking
[AD-A048156] N78-18270
OPTICS
High-speed fabrication of aspherical surfaces — for optical equipment
N78-18900
OPTIMAL CONTROL
Optimal level controls of high performance aircraft
[DLR-IB-552-77/20] N78-18059
Optimal control of a large space telescope using an annular momentum control device
N78-18428
Periodic optimization and controllability of periodic control systems
N78-18821
OPTIMIZATION
Optimal aircraft simulator development by adaptive random search optimization
N78-18082
Substructuring methods for design sensitivity analysis and structural optimization
N78-18230
Low-cost light-weight efficient 1.5 kW inverters with and without output transformers
[AD-A048449] N78-18327
On the use of matrix factorization techniques in penalty function methods for structured linear programs
[IIASA-RM-77-21] N78-18810
Problems in designing a high-speed linear data bus for a multimicroprocessor system
[NPL-COM-89] N78-18817
Periodic optimization and controllability of periodic control systems
N78-18821
Robust design for regression problems
N78-18831
Application of sensitivity theory and optimization techniques to models of large scale systems
N78-18864
Optimal data storage and organization in computerized information processing systems subject to failures
N78-18974
ORBIT CALCULATION
Equal period orbit determination for the solar system planets
[NASA-TM-78156] N78-18092
Orbit determination and orbit prediction from measured data using the ELKORR program
[DLR-IB-552-76/10] N78-18094
Satellite orbit computation methods
[NASA-CR-151600] N78-18096
ORBITAL MECHANICS
Equal period orbit determination for the solar system planets
[NASA-TM-78156] N78-18092
An introduction to shuttle/LDEF retrieval operations: The R-bar approach option — orbital mechanics and braking schedule
[NASA-TM-78668] N78-18105
ORBITAL RENDEZVOUS
An introduction to shuttle/LDEF retrieval operations: The R-bar approach option — orbital mechanics and braking schedule
[NASA-TM-78668] N78-18105
Docking and retrieval mechanism
N78-19036
ORGANIC COMPOUNDS
Transition metal-assisted oxidation of organic compounds
N78-18171
Indexing of structural data on chemical compounds in British universities
[BLL-BLRDR-5355-[2113.56F]]
N78-18982
ORGANIZATIONS
Management strategies in fixed structure models of complex organizations, 2
[AD-A048789] N78-18972
ORGANIZING
Towards a framework of organizational effectiveness
[AD-A047966L] N78-18969
ORGANOMETALLIC COMPOUNDS
Structure and intramolecular interconversions of some organometallic complexes
N78-18170
The synthesis and study of some novel organotransition metal compounds
N78-18172
ORGANS
Effect of prolonged space flight on protein biosynthesis in various rat organs and tissues
N78-18743
Changes in circulating blood volume and filling of the brain and internal organs of rats following acute and chronic hypoxia
N78-18756
ORTHOSTATIC TOLERANCE
Studies of circulation during LBNP test aboard Salyut-4 orbital stations
N78-18719
Dynamics of orthostatic stability of cosmonauts following 2 to 63 day missions
N78-18720
Cardiovascular reactions to orthostatic tests and human resistance to vestibular stimuli
N78-18724
Physiology of antiorthostatism
N78-18730
ORTHOTROPIC PLATES
Existence of solutions for the prestressed non-linear orthotropic heated plates
N78-18247
ORTHOTROPIC SHELLS
Stress and vibration analysis of orthotropic shells of revolution
N78-18449
ORTHOTROPISM
Archives of Mechanics, volume 29, issue 5
N78-18240
OSCILLATION DAMPERS
An active nutation damper for spacecraft
N78-19039
OSCILLATIONS
Prediction of unsteady separated flows on oscillating airfoils
N78-18387
Two-dimensional oscillating airfoil test apparatus
N78-19042
OTOLITH ORGANS
Otolith system function in cosmonauts following space missions
N78-18736
OXIDATION
Silicon oxidation studied by electron spectroscopy
[LYCEN-7719] N78-18167
Transition metal-assisted oxidation of organic compounds
N78-18171
On the oxidation of niobium in pure hydrogen atmospheres
[AD-A047963] N78-18185
Oxidative stabilization of acrylic fibers. 3: Stabilization dynamics
[AD-A048746] N78-18218
OXIDATION-REDUCTION REACTIONS
An investigation of metal versus ligand centered redox processes in selected transition metal macrocyclic complexes. The application of a microcomputer to voltammetry
N78-18153
OXIDE FILMS
Study of the physics of insulating films as related to the reliability of metal-oxide semiconductor devices
[AD-A048483] N78-18328
The effects of transition layers between CVD-vanadium dioxide films and oxide substrates
N78-18947
OXIDES
Investigation of processing microstructures and properties of oxide dispersion strengthened cobalt alloy extruced shapes
[AD-A048593] N78-18198
OXIDIZERS
The relation of oxidant levels to precursor emissions and meteorological features. Volume 1: Analysis and findings
[PB-275001/6] N78-18618
OXYGEN
Flammability assessment tests for organic materials: The oxygen index/temperature index concept
[AD-A047830] N78-18159
The thermodynamic properties of slush hydrogen and oxygen
[NASA-CR-155743] N78-18168
Studies of carbon monoxide and oxygen chemisorbed on palladium and related metals
N78-18173
Dynamic control of parameters of spacecraft atmosphere
N78-18725
OZONE
Ozone over San Francisco. Means and patterns during pollution episodes
[PB-274452/2] N78-18588
The relation of oxidant levels to precursor emissions and meteorological features. Volume 1: Analysis and findings
[PB-275001/6] N78-18618

P

P.A.C.M. TELEMETRY
PSK demodulator. Study report on a demodulator for onboard telemetry decoder
[ESA-CR(P)-968] N78-18114
PACIFIC OCEAN
Mixed layer observations during the NORPAX POLE experiment
[AD-A048581] N78-18664
PALLADIUM
Studies of carbon monoxide and oxygen chemisorbed on palladium and related metals
N78-18173
PARABOLIC ANTENNAS
Rooftop antenna pointing program
[AD-A047999] N78-18111
PARTIAL DIFFERENTIAL EQUATIONS
Boundary value problems and periodic solutions of nonlinear ordinary, functional and partial differential equations
[AD-A048170] N78-18850
Partial differential rate equations for a bilevel absorber
[AD-A048601] N78-18854
PARTIAL PRESSURE
Dynamic control of parameters of spacecraft atmosphere
N78-18725
PARTICLE ACCELERATOR TARGETS
Intense focussed ion beams and their interaction with matter
[AD-A048753] N78-18887
Subsonic gas target 14 MeV neutron generator
N78-18896
PARTICLE BEAMS
Guidelines for the simulation of the degradation of surface properties under combined UV/particle radiation
[ESA-PSS-37/QRM-06T-ISSUE-1] N78-18444
PARTICLE COLLISIONS
Gas surface interactions — recombination reactions with tungsten and platinum
[AD-A048667] N78-18160
Interactions of high-energy particles and Atomic Nuclei with Nuclei, chapter 7 thru 11
[AD-A048311] N78-18885
Low-speed impact phenomena and orbital resonances in the moon- and planet-building process
[NASA-CR-155310] N78-19016
PARTICLE DENSITY (CONCENTRATION)
Evolution of a test particle distribution function in a partially ionized plasma
N78-18923
PARTICLE EMISSION
Emission formation in heterogeneous combustion
[PB-274599/0] N78-18163
Potential for automotive fuel economy improvement
N78-18543
PARTICLE SIZE DISTRIBUTION
Size and composition of atmospheric particles in rural areas near Washington, D. C.
N78-18570
Trace elemental characteristics of aerosols emitted from municipal incinerators
[NASA-TM-78630] N78-18572
PARTICLE TELESCOPES
The determination of symmetrical spherical harmonic distributions from limited data — member of satellite-borne particle telescopes
[ESA-TM-178] N78-18862
PARTICULATE SAMPLING
Multivariate analysis of atmospheric particulate composition and computer-controlled interference correction for ion-selective electrode measurements in a flowing stream
N78-18569
Review and evaluation of analytical methods for environmental studies of fibrous particulate exposures
[PB-274750/9] N78-18591
Control strategy preparation manual for particulate matter
[PB-274861/4] N78-18598
PASSENGERS
Intercity rail energy intensity for passenger movement
N78-18546
The influence of the journey's time of day on the dead resynchronization of the 24-hour rhythm of body and temperature after transatlantic flights
[ESA-TT-420] N78-18708
Passengers in containers
[NASA-TM-75078] N78-18989
A survey on the state of research in automated scheduling of urban passenger transportation
[PB-274587/5] N78-19000
PASSIVITY
Stress corrosion and repassivation behavior of austenitic stainless steels in boiling MgCl2 solution
[ESA-TT-437] N78-18204
System design package: Maxi-therm S-101 heating module, passive heat exchanger
[NASA-CR-150516] N78-18522
PATIENTS
Patient doses resulting from an X-ray recording [belly survey picture]. Influence of technical parameters on the dosage
[IRI-190-77-01] N78-18709
PATRIOT MISSILE
Fly-away restraint pin mechanism for the Army's PATRIOT missile system
N78-19030
PATTERN RECOGNITION
Some applications of discrete analog signal processing to pattern recognition
N78-18818
Applications of pattern recognition and learning controllers to power system analysis and control
N78-18819
PAYLOAD STATIONS
SEAP: A Spacelab experiments propulsive platform for the transport of Spacelab payloads. First study results
[DLR-IB-456-76/1] N78-18109
PAYLOADS
Limitations of the CH-47 helicopter in performing terrain flying with external loads
[AD-A048580] N78-18054
IUS/payload communication system simulator configuration definition study — payload simulator for pcm telemetry
[NASA-CR-151620] N78-18259
PCM TELEMETRY
IUS/payload communication system simulator configuration definition study — payload simulator for pcm telemetry
[NASA-CR-151620] N78-18259
PEARLITE
Mechanism of cleavage fracture in pearlitic eutectoid steel
N78-18176
PENETRATION
Hydro code study
[AD-A048553] N78-18093
Penetration of high explosives by inert projectiles — computerized simulation
[AD-A048326] N78-18227
PERCUSSION
Significance of the percussion symptom in detection of peptic ulcers in flight personnel
N78-18693
PERFORATED PLATES
Experimental and theoretical stress analysis of a fiber reinforced plastic tensile specimen with a hole in it
[ESA-TT-417] N78-18223
PERFORMANCE PREDICTION
Rocket stage mass model for performance prediction
[DLR-IB-456-75/8] N78-18115
A theoretical investigation of spread spectrum modulation concepts and performance
N78-18258
Thermal performance of MSFC hot air collectors under natural and simulated conditions
[NASA-CR-150506] N78-18525
PERFORMANCE TESTS
Evacuated load-bearing high performance insulation study
[NASA-CR-135342] N78-18251
Low profile antenna performance study. Part 2: Broadband antenna techniques survey
[AD-A047992] N78-18274
Performance characteristics of automotive engines in the United States. Report no. 8: Mitsubishi Model 6DS7 diesel engine
[PB-274374/8] N78-18437
Performance characteristics of automotive engines in the United States. Report no. 11: Chrysler [1975] 318-CID 2-bbl engine
[PB-274377/1] N78-18440
The diagnostic facilities in ALGOL and FORTRAN compilers
[NPL-NAC-81] N78-18786
PERSONALITY
Investigation of personality traits of pilots and navigators
N78-18753
PERTURBATION
Perturbation bounds for the definite generalized eigenvalue problem
[AD-A048072] N78-18841
PERTURBATION THEORY
Application and comparison of modal perturbation methods and modal correction procedures exemplified by a swept wing with two external stores
[DLR-FB-77-21] N78-18014
A perturbation expansion for the nonlinear Schrodinger equation with application to the influence of nonlinear Landau damping
[IPPJ-315] N78-18931
PHARMACOLOGY
Psychopharmacology in aviation and astronautics
N78-18716
PHASE DIAGRAMS
A neutron scattering study of monolayer nitrogen films
N78-18944
Phase transitions and critical phenomena: Universality and global multicritical phase diagrams from position-space renormalization-group studies
N78-18945
PHASE SHIFT
A location and navigation method with traveling isophases
[DLR-IB-551-77/4] N78-18035
Comparison between phase shift derived and exactly calculated nucleon-nucleon interaction matrix elements
N78-18893
PHASE TRANSFORMATIONS
Research on martensitic transformations in iron alloys
[AD-A047940] N78-18189
Phase transitions and critical phenomena: Universality and global multicritical phase diagrams from position-space renormalization-group studies
N78-18945
The effects of transition layers between CVD-vanadium dioxide films and oxide substrates
N78-18947
Electronic instability and change of crystalline phase in compounds of the V3Si type at low temperature
[NASA-TM-75178] N78-18953
PHASED ARRAYS
A clutter map for a phased array radar system
[FFM-247] N78-18293
Microstrip reflectarray antenna program
[AD-A048480] N78-18337
PHENOLS
Temperature dependence of the dielectric constant of quartz polymide
[AD-A047850] N78-18136
PHENYLS
Two-photon absorption of molecular crystals and gas — napthalene, biphenyl, and benzene
N78-18950
PHOSPHATES
Determination of optical constants of phosphates, sulphates and ammonia and related compounds in the near infrared region
[AD-A048173] N78-18908
PHOSPHONITRILES
Phosphonitrilic fluoroelastomer fuel hose. Utilization of extruded tubes
[AD-A047960] N78-18432
PHOTOCHEMICAL REACTIONS
The photochemistry of amides and phthalimides
N78-18149
The occurrence of photochemical smog formation in western Europe
[IG-PUBL-597] N78-18583
Measurement of rate constants of importance in smog
[PB-274530/5] N78-18586
Electron transfer at sensitized semiconductor electrodes — photochemical reactions
N78-18949
PHOTODECOMPOSITION
Photon interactions with atmospheric negative ions
[AD-A048315] N78-18611
PHOTOGRAPHS
A system and method for obtaining wide screen schlieren photographs
[NASA-CASE-NPO-14174-1] N78-18396
PHOTOMETRY
The national measurement system for radiometry and photometry
[PB-274643/6] N78-18256
Photometric study of the structure of lenticular galaxies
N78-19009
Photopolarimetry of scattering surfaces and their interpretation by computer model
[NASA-CR-155305] N78-19013
PHOTONS
Photon interactions with atmospheric negative ions
[AD-A048315] N78-18611
Molecular beam studies on multiphoton dissociation of polyatomic molecules
[LBL-6275] N78-18888
Narrowlogy - phenomenology of low energy narrow resonance
[PM/77/6] N78-18890
PHOTOVOLTAIC CONVERSION
Preliminary analysis of an option for the Federal photovoltaic utilization program
[PB-274220/3] N78-18562
PHYSICAL EXERCISE
Mechanics of speech-related respiration while performing static physical exercise
N78-18726
Relationship between onset of altitude-decompression disorders in man and barometric pressure level during intensive physical exercise
N78-18758

PHYSICAL PROPERTIES
Some observations on the structure of Ti-11.5Mo-6Zr-4.5Sn [beta 3] as affected by processing history
[AD-A048772] N78-18195
PHYSICS
National Bureau of Standards Journal of Research, section A: Physics and Chemistry, volume 81A, numbers 2 and 3, March - June 1977
[PB-275037/0] N78-18169
PHYSIOLOGY
Influence of central venous pressure upon sinus node responses to arterial baroreflex stimulation in man
[NASA-CR-155783] N78-18678
Physiology of antiorthostatism N78-18730
PIEZOELECTRIC TRANSDUCERS
Cantilever accelerometer
[AD-A048045] N78-18398
PILOT PERFORMANCE
A comparison of integrated and conventional cockpit warning systems — pilot performance and reaction time in man machine systems
[AD-A048670] N78-18022
Analytical study of ride smoothing benefits of control system configurations optimized for pilot handling qualities
[NASA-TP-1148] N78-18076
PILOT PLANTS
Pilot plant study of conversion of coal to low sulfur fuel
[PB-274113/0] N78-18565
PILOT TRAINING
Autogenic training used for self-regulation of cardiovascular function and prevention of neurocirculatory dystonia in pilot candidates N78-18694
PILOTS
Assessing pilot workload
[AGARD-AG-233] N78-18770
PILOTS [PERSONNEL]
Sudden loss of consciousness in pilots with low intraocular pressure during exposure to G forces N78-18737
Investigation of personality traits of pilots and navigators N78-18753
A personal cooling system for helicopter pilots
[AD-A047649] N78-18767
PINS
Fly-away restraint pin mechanism for the Army's PATRIOT missile system N78-19030
PIONEER VENUS SPACECRAFT
Magnetometer deployment mechanism for Pioneer Venus N78-19029
PIONEER 6 SPACE PROBE
Solar-geophysical data number 397, September 1977. Part 1: Data for August - July 1977
[PB-274823/4] N78-19023
PIPELINES
Energy and economic impacts of projected freight transportation improvements N78-18537
PLANETARY ENVIRONMENTS
Finite element solution to equations for turbulent motion and diffusion in planetary boundary layer N78-18605
Significant achievements in the planetary program, 1976 - 1977
[NASA-CR-2956] N78-19022
PLANETARY EVOLUTION
Low-speed impact phenomena and orbital resonances in the moon- and planet-building process
[NASA-CR-155310] N78-19016
Significant achievements in the planetary program, 1976 - 1977
[NASA-CR-2956] N78-19022
PLANETOLOGY
Significant achievements in the planetary program, 1976 - 1977
[NASA-CR-2956] N78-19022
PLANETS
Equal period orbit determination for the solar system planets
[NASA-TM-78156] N78-18092
PLANTS [BOTANY]
A plant canopy light absorption model with application to wheat
[NASA-CR-155778] N78-18500
Investigation of concomitant microflora in prolonged substrate-free cultivation of beet plants N78-18729
PLASMA CLOUDS
Soliton and generation of cloud in nonlinear dispersive media with weak dissipation
[IPPJ-312] N78-18928
PLASMA CONTROL
A poloidal divertor model for Tokamak fusion reactors N78-18924
PLASMA DENSITY
Reflection and absorption of ion-acoustic waves in a plasma density gradient N78-18926
Optical escape factors for Doppler profiles in spherical, cylindrical and plane parallel geometries
[IPPJ-317] N78-18933
Steady state radiative cooling rates for low-density high-temperature plasmas
[PPPL-1352] N78-18940
PLASMA DIAGNOSTICS
Diagnosis of a relativistic nonneutral plasma column based on the synchrotron radiation spectrum, theory and experiment N78-18922
PLASMA HEATING
Non-stochastic heating of magnetized plasma by electrostatic wave
[IPPJ-314] N78-18930
PLASMA INTERACTIONS
Microwave simulation of laser plasma interactions
[UCRL-13752] N78-18423
PLASMA JETS
Comparative characteristics of electron energy spectrum in PIG and arc type discharge plasmas
[NASA-TM-75255] N78-18307
Synthesis of silane and silicon in a non-equilibrium plasma jet
[NASA-CR-155933] N78-18518
PLASMA PHYSICS
Reflection and absorption of ion-acoustic waves in a plasma density gradient N78-18926
Interconnected linear theta pinches
[IPPJ-316] N78-18932
Optical escape factors for Doppler profiles in spherical, cylindrical and plane parallel geometries
[IPPJ-317] N78-18933
PLASMA TEMPERATURE
Steady state radiative cooling rates for low-density high-temperature plasmas
[PPPL-1352] N78-18940
PLASMA WAVES
Wave trajectory and electron cyclotron heating in toroidal plasmas
[IPPJ-313] N78-18929
PLASMA-ELECTROMAGNETIC INTERACTION
Wave trajectory and electron cyclotron heating in toroidal plasmas
[IPPJ-313] N78-18929
PLASMAS [PHYSICS]
Morphological studies of rising equatorial spread F bubbles
[AD-A048752] N78-18612
Evolution of a test particle distribution function in a partially ionized plasma N78-18923
A perturbation expansion for the nonlinear Schrodinger equation with application to the influence of nonlinear Landau damping
[IPPJ-315] N78-18931
Modulated langmuir waves and nonlinear Landau damping — Schroedinger equation
[IPPJ-319] N78-18935
Atomic reactions in very high temperature plasmas
[CONF-770721-1] N78-18937
PLASTIC DEFORMATION
Composites-analysis of non-homogeneous deformation of composite materials
[AD-A048430] N78-18141
Finite deformation, elastic-plastic, finite element analysis of planar cracks N78-18447
PLASTIC PROPERTIES
Archives of Mechanics, volume 29, issue 5 N78-18240
Disclination kinematics N78-18241
Plasticity of polycrystal N78-18245
Impact damage in brittle materials in the plastic response regime
[AD-A048266] N78-18430
Theoretical studies of cyclic straining in polycrystalline metal plasticity N78-18454
PLASTICS
Investigations of rocket propellants using tracers. Life testing of plastic propellant gases
[BMVG-FBWT-77-14] N78-18228
PLATES [STRUCTURAL MEMBERS]
Microwave dichroic plate
[NASA-CASE-GSC-12171-1] N78-18313
Microchannel plate response to hard X-rays
[SAND-77-8621] N78-18403
Estimating fatigue crack initiation and propagation lives in notched plates under variable loading histories N78-18451
PLATING
Gas surface interactions — recombination reactions with tungsten and platinum
[AD-A048667] N78-18160
PLATINUM
Real-time computer optimized scanning potential coulometry for multi-component trace analysis N78-18152
Resistance ratio/temperature relationships for industrial platinum resistance thermometers of thick film construction
[NPL-QU-42] N78-18407
PLUMES
Effects of vertical distortion on thermalhydraulic modeling of surface discharges N78-18479
POINTING CONTROL SYSTEMS
Design and development of a solar array drive — a direct drive solar array pointing mechanism N78-19046
POINTS [MATHEMATICS]
Totally and partially ambiguous points of planar functions N78-18834
POISSON DENSITY FUNCTIONS
A goodness-of-fit test for a class of nonhomogeneous Poisson processes
[AD-A048180] N78-18844
POLAR COORDINATES
Systems for the determination of polar motion
[PB-274698/0] N78-18617
POLARIMETRY
Photopolarimetry of scattering surfaces and their interpretation by computer model
[NASA-CR-155305] N78-19013
POLARITY
Theory of surface polaritons in n-InSb in the presence of a DC current and an external DC magnetic field
[AD-A048217] N78-18959
POLARIZATION
Polarized infrared spectral studies of crystalline, hydrogen-bonded organic acids
[AD-A048587] N78-18162
POLARIZATION [WAVES]
Intensity, angular distribution and polarization of spontaneous molecular light scattering
[ESA-TT-438] N78-18298
Polarized light: Definitions and nomenclature
[NPL-MOM-25] N78-18921
POLARIZED LIGHT
Polarized light: Definitions and nomenclature
[NPL-MOM-25] N78-18921
POLISHING
Chemically polished quartz — using ammonium bifluoride
[AD-A048077] N78-18958
POLITICS
International transfer of marine technology, a three-volume study — social, political and economic factors
[PB-275353/1] N78-18986
POLLUTION CONTROL
Advanced fossil fuel and the environment: An executive report
[PB-274541/2] N78-18587
Gas-atomized spray scrubber evaluation
[PB-274449/8] N78-18589
Proceedings of the 2d Stationary Source Combustion Symposium. Volume 5: Addendum
[PB-274897/8] N78-18590
Diffuse source pollution: Policy considerations for the states
[PB-274493/6] N78-18592
EPA fabric filtration studies. 5: Bag cleaning technology, high temperature tests
[PB-274922/4] N78-18596
Control strategy preparation manual for particulate matter
[PB-274861/4] N78-18598
POLLUTION MONITORING
Trace elements in water: A development and application of sampling and sample handling procedures N78-18571
Vehicle exhaust emission instruments evaluation
[PB-274547/9] N78-18597
POLYATOMIC MOLECULES
Molecular beam studies on multiphoton dissociation of polyatomic molecules
[LBL-6275] N78-18888
POLYCRYSTALS
Plasticity of polycrystal N78-18245
Theoretical studies of cyclic straining in polycrystalline metal plasticity N78-18454
POLYETHYLENE TEREPHTHALATE
Chemical degradation and stress-cracking of drawn poly[ethylene terephthalate] fibers N78-18209
POLYMER CHEMISTRY
Temperature dependence of jet swell and material functions in polymer melt systems N78-18206
POLYMERS
Flammability assessment tests for organic materials: The oxygen index/temperature index concept
[AD-A047830] N78-18159

POLYNOMIALS
Inductive extrapolation: A system for program synthesis from exemplary data employing regular grammar inference and polynomial separation of machine states
N78-18789
Correspondences and admissible polynomials
N78-18839
POLYSACCHARIDES
Mucopolysaccharides and collagen of tissues in hypokinetic rats
N78-18723
POLYSTYRENE
Investigation of the T sub LL [T sub g] relaxation in homopolymers and block copolymers of styrene by torsional braid analysis
[AD-A048455] N78-18219
POPULATIONS
Radiological quality of the environment in the United States, 1977
[PB-274229/4] N78-18710
POROSITY
DOT behavior of waxed mixtures pf RDX, HMX, and tetryl
[AD-A047968L] N78-18225
PORPHYRINS
Method and apparatus for eliminating luminol interference material
[NASA-CASE-MSC-16260-1] N78-18674
PORTABLE EQUIPMENT
A study for hypergolic vapor sensor development
[NASA-CR-155770] N78-18224
POSITION (LOCATION)
LORAN automatic vehicle monitoring system, Phase 1. Volume 1: Test results
[PB-274955/4] N78-18034
A location and navigation method with traveling isophases
[DLR-IB-551-77/4] N78-18035
LORAN automatic vehicle monitoring system, phase 1. Volume 2: Appendices
[PB-274956/2] N78-18039
POSITION INDICATORS
Solar cell angular position transducer
[NASA-CASE-LAR-11999-1] N78-18394
POSTFLIGHT ANALYSIS
Medical support of the immediate postflight period following long space missions
N78-18741
POSTURE
Evaluation of postural mechanisms under dynamic conditions
[NASA-CR-151638] N78-18700
POTABLE WATER
Wastewater characterization and process reliability for potable wastewater reclamation
[PB-274874/7] N78-18992
POTENTIAL THEORY
A method for calculation of the pressure distribution of wing-body configurations for large angle of attack at subsonic speed — based on potential theory
[BMVG-FBWT-77-15] N78-18013
POTENTIOMETRIC ANALYSIS
Application of minicomputers to studies in electroanalytical chemistry
N78-18148
POWDER (PARTICLES)
Model laws for granular media and powders with a special view to silo models
N78-18235
POWDER METALLURGY
High pressure hot pressing of tantalum carbide to attain a two hundred angstrom grain size
N78-18179
PREAMPLIFIERS
An electric current preamplifier associated to the cathodic planes of proportional multiwire chambers
[LYCEN-7705] N78-18342
PRECIPITATION (METEOROLOGY)
As-built design specification for the digital derivation of daily and monthly data bases from synoptic observations of temperature and precipitation for the People's Republic of China
[NASA-CR-151616] N78-18624
PREDICTION ANALYSIS TECHNIQUES
A new experimental method for the accelerated characterization of composite materials
[VPI-E-78-3] N78-18132
Prediction of the severity of buffeting — wind tunnel tests
N78-18382
Prediction of separation using boundary layer theory
N78-18386
PRESSING (FORMING)
Technological and experimental investigations of window frames in FRP winding press technology — glass and carbon reinforced plastics
[DLR-IB-152-77/10] N78-18254
PRESSURE DISTRIBUTION
A method for calculation of the pressure distribution of wing-body configurations for large angle of attack at subsonic speed — based on potential theory
[BMVG-FBWT-77-15] N78-18013
Analytical solution of the generalized Helmholtz wave equation for compressible subsonic flow and calculation of the unsteady pressure distributions about oscillating spheroids
[ESA-TT-421] N78-18017
Unsteady pressure measurements on wing-store combinations in incompressible flow
[ESA-TT-426] N78-18018
Investigation of the unsteady pressure distribution on the blades of an axial flow fan
[NASA-CR-15571] N78-18068
PRESSURE EFFECTS
Effects of pressure on ion exchange and ion pairing chromatography
N78-18154
Influence of low and high pressure baroreceptors on plasma renin activity in humans
[NASA-CR-155307] N78-18701
PRESSURE GAGES
Design and calibration of 5-point conical pressure probes for measuring in supersonic flow
[DLR-FB-77-28] N78-18015
PRESSURE GRADIENTS
Investigation of the unsteady pressure distribution on the blades of an axial flow fan
[NASA-CR-15571] N78-18068
PRESSURE MEASUREMENTS
Design and calibration of 5-point conical pressure probes for measuring in supersonic flow
[DLR-FB-77-28] N78-18015
PRESSURE REDUCTION
Relationship between onset of altitude-decompression disorders in man and barometric pressure level during intensive physical exercise
N78-18758
PRESSURE REGULATORS
Use of fluid injection to regulate the combustion chamber pressure for unstably burning solid propellant combustion
[DLR-IB-456-77/4] N78-18124
PRESSURE VESSELS
Fabrication of pressure tank using HY-100 steel
[AD-A048767] N78-18433
Failure analysis of pressure vessels with defects
[OUEL-1209/77] N78-18472
PRESTRESSING
Existence of solutions for the prestressed non-linear orthotropic heated plates
N78-18247
PRETREATMENT
Investigation of magnetic water treatment devices -- - calcium carbonate scale retardation
N78-18987
PRINTED CIRCUITS
An algorithm for testing the planarity of partially oriented graphs
[AD-A048052] N78-18314
PRISMS
Design for high accuracy critical-angle sun transit sensor
[AD-A048287] N78-18911
PROBABILITY DISTRIBUTION FUNCTIONS
On the distribution of the greatest common divisor
[AD-A048791] N78-18853
Distribution of a sum of order statistics from the gamma distribution
[AD-A048127] N78-18859
PROBABILITY THEORY
Random coverage problems in geometrical probability with an application to time series analysis
N78-18857
PROBLEM SOLVING
Approximation by algebraic numbers of bounded degree
N78-18835
PROCEDURES
Guidelines for the regional evaluation of state and local NSR [New Source Review] programs
[PB-275053/7] N78-18582
PROCEEDINGS
Applications of non-intrusive instrumentation in fluid flow research
[AGARD-AR-112] N78-18374
Proceedings of the 2d Stationary Source Combustion Symposium. Volume 5: Addendum
[PB-274897/8] N78-18590
PROCUREMENT POLICY
Developing an acquisitions system for a university library
[BLL-BLRDR-5351] N78-18983
PRODUCT DEVELOPMENT
Planning for Materials Processing in Space
[NASA-CR-155786] N78-18090
Chemical use classification system
[PB-275106/3] N78-18129
PRODUCTION ENGINEERING
A production engineering measure for two L-band solid state microwave frequency sources
[AD-A047903] N78-18315
Complex materials handling and assembly systems
[PB-274539/6] N78-18434
Complex materials handling and assembly systems
[PB-274540/4] N78-18435
Phase 1 of the automated array assembly task of the low cost silicon solar array project
[NASA-CR-155935] N78-18516
Energy requirement for the production of silicon solar arrays
[NASA-CR-155932] N78-18519
PRODUCTION MANAGEMENT
Manufacturing methods and technology engineering high-efficiency, high-power gallium arsenide read-type IMPATT diodes, volume 2
[AD-A048579] N78-18334
Manufacturing methods and technology engineering high-efficiency, high-power gallium arsenide read-type IMPATT diodes, volume 1
[AD-A048578] N78-18335
PROGRAMMING LANGUAGES
On the use of programming knowledge to understand informal process description
[AD-A048153] N78-18802
PROJECT MANAGEMENT
Multimedium management of municipal sludge, volume 9
[PB-274093/4] N78-18998
PROJECT PLANNING
The next 25 years: Industrialization of space: Rationale for planning
[NASA-TM-79360] N78-18091
Space shuttle, 1978
[GPO-99-072] N78-18106
On the development of earth observation satellite systems
[NASA-TM-75064] N78-18490
Directions in US water research: 1978 - 1982
[PB-274278/1] N78-18511
Outline of the energy-related projects sponsored by the Federal Railroad Administration, DOT
N78-18544
Electric car technology for demonstration and development
N78-18551
HUD/PTI Information Systems Improvement Program. Planning and management: A methodology guide
[PB-274179/1] N78-18996
PROJECT SETI
The search for extraterrestrial intelligence [SETI]
[NASA-SP-419] N78-18771
PROJECTILES
Penetration of high explosives by inert projectiles — computerized simulation
[AD-A048326] N78-18227
PROJECTIVE GEOMETRY
Fake quaternionic projective spaces from a homotopy point of view
N78-18869
PROPAGATION VELOCITY
Velocities of compressional wave in rocks of central California at high pressure and high temperature and applications to the study of the crustal structure of California coast ranges
N78-18606
PROPANE
On the prediction of mass flow rates of propane
N78-18350
PROPELLANT TANKS
SEAP - configuration and cost analysis — Spacelab experiment propulsion platform
[DLR-IB-456-77/2] N78-18108
PROPELLER DRIVE
Experimental determination and comparison with theory of thrust, noise and driving weight of propeller drives — light aircraft Sportavia S5
[BMVG-FBWT-77-16] N78-18072
PROPELLERS
Experimental determination and comparison with theory of thrust, noise and driving weight of propeller drives — light aircraft Sportavia S5
[BMVG-FBWT-77-16] N78-18072
PROPORTIONAL COUNTERS
An electric current preamplifier associated to the cathodic planes of proportional multiwire chambers
[LYCEN-7705] N78-18342
Amplification and discrimination of signals from proportional multiwire chambers
[ISS-T-76/6] N78-18344
PROPULSION
Variable mixer propulsion cycle
[NASA-CASE-LEW-12917-1] N78-18067
PROPULSION SYSTEM CONFIGURATIONS
Preliminary design study of a propulsion platform for transport of Spacelab payloads — chemical propulsion
[DLR-IB-456/76-6] N78-18107
SEAP - configuration and cost analysis — Spacelab experiment propulsion platform
[DLR-IB-456-77/2] N78-18108
SEAP: A Spacelab experiments propulsive platform for the transport of Spacelab payloads. First study results
[DLR-IB-456-76/1] N78-18109
Tripropellant engine study
[NASA-CR-150562] N78-18119
USAP - a universal standardized propulsion platform for the transport of Spacelab payloads
[DLR-IB-456/75-9] N78-18123

PROPULSION SYSTEM PERFORMANCE
The main propulsion system of the U.S. space shuttle. An example of the performance increase of propulsion systems of single stage launch rockets
[DLR-IB-76-3] N78-18110
State-of-the-art assessment of electric vehicles and hybrid vehicles
[NASA-TM-73756] N78-18988
PROSTHETIC DEVICES
The chemical, mechanical, and implant properties of glass-coated alumina
N78-18130
Drop foot corrective device
[NASA-CASE-LAR-12259-1] N78-18762
PROTECTION
The helmet protects the aviator's head - or does it
[AD-A048574] N78-18766
PROTECTIVE COATINGS
Exploratory development of conductive coating materials — for use on aircraft radomes
[AD-A048253] N78-18138
Applications of quantum electronics. Part 2: The metal coating of optical fibres
[OUEL-1184/77-PT-2] N78-18918
PROTEINS
Influence of low and high pressure baroreceptors on plasma renin activity in humans
[NASA-CR-155307] N78-18701
Effect of prolonged space flight on protein biosynthesis in various rat organs and tissues
N78-18743
Cytochemical studies of proteins and RNA in individual spinal cord motoneurons and spinal ganglia neurons of rats following a space flight
N78-18744
PROTONS
Hemopoiesis in dogs exposed to lethal doses of protons with shielded bone marrow
N78-18728
Cataractogenic effect of 25 and 50 MeV protons
N78-18751
PROVING
COBOL compiler validation
[AD-A048319] N78-18779
Verifying concurrent programs with shared data classes
[AD-A048637] N78-18808
PROXIMITY
Space shuttle proximity operation sensor study
[NASA-CR-151634] N78-18118
PSYCHOLOGICAL EFFECTS
Clinical and biochemical aspects of human adaptation to central Antarctica as applied to problems of space biology and medicine
N78-18746
PSYCHOLOGY
Some psychoneurological requirements in assessing inflight functional state of cosmonauts
N78-18721
PSYCHOPHYSIOLOGY
Psychopharmacology in aviation and astronautics
N78-18716
Evoked cortical potentials and information processing
[AD-A048647] N78-18760
PUBLIC HEALTH
Technical and scientific aspects of sanitary and safety problems in nuclear energy production
[ISS-P-76/9] N78-18706
PUBLIC RELATIONS
The independent learning project: A study of changing attitudes in American public libraries
[BLL-BLRDR-5396-(2113.56F)]
N78-18984
PULMONARY CIRCULATION
Influence of low and high pressure baroreceptors on plasma renin activity in humans
[NASA-CR-155307] N78-18701
PULSE DOPPLER RADAR
C-band radar pulse Doppler error: Its discovery, modeling, and elimination
[NASA-TM-69366] N78-18265
PULSE FREQUENCY MODULATION
Uplink coverage measurements in the Los Angeles area for passive BCAS — collision avoidance
[AD-A048288] N78-18027
PUMPS
Study of an air lift pump in a centrifugal force field
[DLR-FB-77-40] N78-18436
PUNCHES
Calculations of stresses in wall ironing
[OUEL-1187/77] N78-18469
PYRANOMETERS
The use of pyranometers in aircraft
[ESA-TT-433] N78-18408
PYROELECTRICITY
Design of a pyro-electric vidicon camera for medical thermography
[THT-TM-77-009] N78-18707
PYROLYSIS
Toxicity of pyrolysis gases from synthetic polymers
[NASA-TM-78458] N78-18127

Q

Q FACTORS
High Q selective filters using mechanical resonance of silicon beams
N78-18304
QUADRATURES
Quadrature approximation of Bayesian recursive computations and the implementation of nonlinear estimators
N78-18794
QUALITY CONTROL
Guidelines for space materials selection
[ESA-PSS-07/QRM-01-ISSUE-3]
N78-18116
QUANTUM ELECTRODYNAMICS
Improved quantum receivers for optical communication
[AD-A048688] N78-18280
Double optical resonance — quantum electrodynamics and emission spectra from atomic excitations
N78-18901
The two level atom of quantum optics
N78-18902
Optically induced hot electron effects in semiconductors
[AD-A048194] N78-18956
QUANTUM MECHANICS
Momentum distributions and one-body density matrices of the quantum fluids
N78-18348
Macroscopic description of laser-type matter
[AD-A048442] N78-18422
Formal and computational studies of molecular collision dynamics
N78-18880
Comparison between phase shift derived and exactly calculated nucleon-nucleon interaction matrix elements
N78-18893
QUARTZ
Temperature dependence of the dielectric constant of quartz polymide
[AD-A047850] N78-18136
Study of radiation-hardened quartz production processes
[AD-A048264] N78-18317
Chemically polished quartz — using ammonium bifluoride
[AD-A048077] N78-18958
QUARTZ CRYSTALS
Four-point mounting configuration for resonators subjected to severe environments
[AD-A048069] N78-18326
QUASI-STEADY STATES
Phenomenological aspects of quasi-stationary controlled and uncontrolled three-dimensional flow separations
N78-18380
QUEUEING THEORY
Simulation of the 10-node data communication network operating with link speeds of 9.6 Kb/s
[NPL-COM-87] N78-18297

R

RACETRACKS [PARTICLE ACCELERATORS]
The Monte Carlo simulation of the Ladon photon beam facility — backward Compton scattering of argon laser light with storage ring electrons
[ISS-P-76/10] N78-18425
RADAR ANTENNAS
Special evaluation for pedestal-level stability of height-finder radars on temperate towers
[AD-A048604] N78-18284
RADAR BEACONS
Uplink coverage measurements in the Los Angeles area for passive BCAS — collision avoidance
[AD-A048288] N78-18027
The impact of a proposed active BCAS on ATCBBS performance in the Washington, D. C., 1981 environment
[AD-A048589] N78-18032
RADAR CLUTTER MAPS
A clutter map for a phased array radar system
[FFM-247] N78-18293
RADAR CROSS SECTIONS
Determination of antenna radiation patterns, radar cross sections and jam-to-signal ratios by flight tests
[NLR-MP-76023-U] N78-18289
RADAR DATA
Test and evaluation of the Moving Target Detector (MTD) radar
[AD-A04788] N78-18260
RADAR DETECTION
Space shuttle proximity operation sensor study
[NASA-CR-151634] N78-18118
Sea nymph pilot LCC model development
[AD-A048109] N78-18278
Numerical problems in resolving near-neighbor targets — radar targets
[FFM-248] N78-18294
RADAR ECHOES
A clutter map for a phased array radar system
[FFM-247] N78-18293
RADAR EQUIPMENT
Standard electronic module radar cost analysis
[AD-A048207] N78-18319
RADAR FILTERS
Radar fixed echo suppression by prefiltering at constant radiation direction
[FFM-257] N78-18295
RADAR IMAGERY
Clutter free synthetic aperture radar correlator
[NASA-CASE-NPO-14035-1] N78-18266
Synthetic aperture radar image processing techniques development and evaluation
[AD-A048193] N78-18269
Cropland inventories using an orbital imaging radar
N78-18478
RADAR MEASUREMENT
Special evaluation for pedestal-level stability of height-finder radars on temperate towers
[AD-A048604] N78-18284
RADAR RECEIVERS
A system analysis of the 13.3 GHz — antenna patterns and signal transmission
[NASA-CR-151627] N78-18496
RADAR RESOLUTION
Numerical problems in resolving near-neighbor targets — radar targets
[FFM-248] N78-18294
RADAR TARGETS
Numerical problems in resolving near-neighbor targets — radar targets
[FFM-248] N78-18294
RADIANCE
Activities of the Quantum Metrology Division
[NPL-QU-AR75] N78-18973
RADIATION ABSORPTION
Partial differential rate equations for a bilevel absorber
[AD-A048601] N78-18854
RADIATION DAMAGE
Effects of gamma radiation on gallium-arsenide lasers
[AD-A048361] N78-18418
Guidelines for the simulation of the degradation of surface properties under combined UV/particle radiation
[ESA-PSS-37/QRM-06T-ISSUE-1]
N78-18444
Cataractogenic effect of 25 and 50 MeV protons
N78-18751
RADIATION DOSAGE
Study of radiation-hardened quartz production processes
[AD-A048264] N78-18317
Patient doses resulting from an X-ray recording (belly survey picture). Influence of technical parameters on the dosage
[IRI-190-77-01] N78-18709
Radiological quality of the environment in the United States, 1977
[PB-274229/4] N78-18710
RF cell culture irradiation system with controlled temperature and field strength
[PB-274793/9] N78-18712
Space Biology and Aerospace Medicine, no. 3, 1977
[JPRS-69380] N78-18715
Measurement of radiation doses in the Soyuz-16 spacecraft
N78-18732
NEXT - instruction manual — nationwide evaluations of X-ray trends
[ISS-T-77/1] N78-18889
RADIATION EFFECTS
Radiation effects on AlGaAs/GaAs solar cells using 0.9-3.0 MeV protons and 1.0-1.4 MeV electrons
[AD-A048037] N78-18557
Biological effects of nonionizing electromagnetic radiation Volume 2: Number 2, December 1977
[AD-A047647] N78-18705
EDP network analysis for electronics in nuclear radiation environment
[BMVG-FBWT-77-13] N78-18899
RADIATION HARDENING
Study of radiation-hardened quartz production processes
[AD-A048264] N78-18317
RADIATION MEASURING INSTRUMENTS
Measurement of RF power-absorption in biological specimens, 10 to 100 MHz
[PB-274218/7] N78-18714
RADIATION SPECTRA
Diagnosis of a relativistic nonneutral plasma column based on the synchrotron radiation spectrum, theory and experiment
N78-18922
RADIATIVE HEAT TRANSFER
Steady state radiative cooling rates for low-density high-temperature plasmas
[PPPL-1352] N78-18940

RADIO ALTIMETERS
Short arc reduction of radar altimetry computer program
[NASA-CR-141434] N78-18798
RADIO COMMUNICATION
Communication system performance model for VHF and higher frequencies
[PB-274458/9] N78-18299
RADIO CONTROL
Flight tests of a radio-controlled airplane mode with a free-wing, free-canard configuration
[NASA-TM-72853] N78-18042
RADIO FREQUENCIES
NBS type 4 RF power meter operation and maintenance
[PB-274456/3] N78-18402
Measurement of RF power-absorption in biological specimens, 10 to 100 MHz
[PB-274218/7] N78-18714
RADIO FREQUENCY INTERFERENCE
Objective measurement of voice channel intelligibility
[AD-A048611] N78-18264
Interference to audio devices and receivers from signals near 27, 220 and 900 MHz
[PB-274887/9] N78-18879
RADIO PROBING
The characteristics of broadband, isotropic electrical field and magnetic field probes
[PB-274457/1] N78-18339
RADIO RELAY SYSTEMS
Programmable Data Terminal Set [PDTS] UHF test with AN/WSC-3 radio. Operational capability of PDTS is demonstrated
[AD-A048295] N78-18281
Method of measurement of rainfall intensity with the combined use of capacitor and tipping-bucket rain gauges
N78-18654
Software acquisition management guidebook: Verification
[AD-A048577] N78-18807
RADIO SIGNALS
Prediction of transionospheric signal time delays using correlative techniques
[AD-A047917] N78-18268
Interaction of electromagnetic and acoustic waves in a stochastic atmosphere
[NASA-CR-155746] N78-18275
Sea nymph pilot LCC model development
[AD-A048109] N78-18278
RADIO SOURCES [ASTRONOMY]
Models for X-ray and radio emission from clusters of galaxies
N78-19006
Search for correlated radio and optical events in long-term studies of extragalactic sources
N78-19018
RADIO TRANSMISSION
Application of a root finding method for tropospheric ducting produced by trilinear refractivity profiles
[AD-A047916] N78-18267
Communication system performance model for VHF and higher frequencies
[PB-274458/9] N78-18299
Interference to audio devices and receivers from signals near 27, 220 and 900 MHz
[PB-274887/9] N78-18879
RADIO WAVES
Wideband satellite observations
[AD-A048801] N78-18282
RADIOACTIVE WASTES
An analysis of the technical status of high level radioactive waste and spent fuel management systems
[NASA-CR-155313] N78-18897
RADIOACTIVITY
Radiological quality of the environment in the United States, 1977
[PB-274229/4] N78-18710
RADIOBIOLOGY
Main objectives and results of the radiobiological experiment conducted on the Kosmos-690 biosatellite
N78-18688
Biological effects of nonionizing electromagnetic radiation Volume 2: Number 2, December 1977
[AD-A047647] N78-18705
RADIOMETERS
Optimization of the design parameters for a wideband radiometric system
[NASA-TM-78662] N78-18117
The national measurement system for radiometry and photometry
[PB-274643/6] N78-18256
Scanning and focusing mechanisms of METEOSAT radiometer
N78-19028
RADOMES
Exploratory development of conductive coating materials — for use on aircraft radomes
[AD-A048253] N78-18138
RAIL TRANSPORTATION
Energy use in intercity freight transport and policy implications
N78-18536
Energy and economic impacts of projected freight transportation improvements
N78-18537
Outline of the energy-related projects sponsored by the Federal Railroad Administration, DOT
N78-18544
Measurement and simulation of fuel consumption in rail freight service
N78-18545
Electrification of railroads problems-potentials-economic impacts
N78-18550
RAIN
Forecasting daily rainfall amount for a single station using satellite photographs
[TN-21] N78-18621
RAIN GAGES
Experimental measurements for the evaluation of the accuracy of tipping-bucket rain gauges used in the research program on radio propagation frequencies above 10 GHz
N78-18653
Method of measurement of rainfall intensity with the combined use of capacitor and tipping-bucket rain gauges
N78-18654
RAMAN SPECTRA
The development of a parallel-channel spectrographic detector: Applications to Raman scattering
N78-18903
RANDOM NOISE
An investigation of the bearing accuracy of two passive multi-channel array algorithms in the presence of correlated noise
N78-18791
RANDOM PROCESSES
Optimal aircraft simulator development by adaptive random search optimization
N78-18082
Numerical methods for the statistical analysis of random processes by means of computers
[NASA-TT-F-17159] N78-18795
RANGEFINDING
Ambiguous range study report
[AD-A048612] N78-18033
RAPID TRANSIT SYSTEMS
Intercity rail energy intensity for passenger movement
N78-18546
RARE EARTH COMPOUNDS
Magnetic LPE crystalline films for small bubble diameter cylindrical-domain memory applications
[AD-A048197] N78-18957
RARE GASES
Attachment rates in rare gas halide lasers
[AD-A048764] N78-18420
RAYLEIGH WAVES
Ellipticity of 0.4 to 2.4 Hertz Rayleigh waves with application to the study of near surface earth structure
N78-18600
RDX
DOT behavior of waxed mixtures pf RDX, HMX, and tetryl
[AD-A047968/L] N78-18225
REACTION KINETICS
Simultaneous kinetic and spectral analysis using a vidicon rapid-scanning stopped-flow spectrometer
N78-18155
Reaction kinetics and structure of enzyme macromolecules subjected to hydrodynamic shearing forces: Enzyme mechanochemistry
N78-18210
Chemical laser potential of selected group 4-A metal oxides
[AD-A048779] N78-18419
Measurement of rate constants of importance in smog
[PB-274530/5] N78-18586
REACTION TIME
A comparison of integrated and conventional cockpit warning systems — pilot performance and reaction time in man machine systems
[AD-A048670] N78-18022
READ-ONLY MEMORY DEVICES
Reliability evaluation of programmable read-only memories [PROMs], part 2
[AD-A048231] N78-18800
REAL TIME OPERATION
Palefac
[AD-A048331] N78-18065
A users guide to the GEODSS real-time system
[AD-A048300] N78-18113
Real-time computer optimized scanning potential coulometry for multi-component trace analysis
N78-18152
Real-time computer techniques in the detection and analysis of severe storms from digital radar data
N78-18622
RECEIVERS
Interference to audio devices and receivers from signals near 27, 220 and 900 MHz
[PB-274887/9] N78-18879
RECOMBINATION REACTIONS
Gas surface interactions — recombination reactions with tungsten and platinum
[AD-A048667] N78-18160
RECORDING INSTRUMENTS
Electron beam recorder applications study
[AD-A048666] N78-18399
Wideband holographic digital recording and reproduction
[AD-A048464] N78-18401
Design of a pyroelectric vidicon camera for medical thermography
[THT-TM-77-009] N78-18707
RECREATION
New Castle County Delaware River shoreline study
[PB-275317/6] N78-18670
RECURSIVE FUNCTIONS
Quadrature approximation of Bayesian recursive computations and the implementation of nonlinear estimators
N78-18794
REDUCED GRAVITY
The hematic system in the set of symptoms of autonomic disorders in monkeys on the low gravitation stand
N78-18757
REENTRY VEHICLES
Hydro code study
[AD-A048553] N78-18093
REFLECTION
Investigation of ground reflection and impedance from flyover noise measurements
[NASA-CR-145302] N78-18874
REFRACTION
Reflection and refraction of solitary waves: A numerical investigation
N78-18659
REFRACTIVITY
Adaptive mapping of mid-latitude ionosphere
[AD-A048116] N78-18607
REFRACTORY MATERIALS
Survey of ceramic refractory problems and materials shortages
[AD-A048108] N78-18216
REGRESSION ANALYSIS
Improvement of flight measuring data with a Kalman filter
[BMVG-FBWT-77-6] N78-18057
Regression estimation for multivariate normal distributions
N78-18830
Robust design for regression problems
N78-18831
REINFORCING FIBERS
Fuselage structure using advanced technology metal matrix fiber reinforced composites
[NASA-CASE-LAR-11688-1] N78-18045
Third Conference on Fibrous Composites in Flight Vehicle Design, part 1
[NASA-TM-X-3377-PT-1] N78-18133
Third Conference on Fibrous Composites in Flight Vehicle Design, part 2
[NASA-TM-X-3377-PT-2] N78-18134
Technological and experimental investigations of window frames in FRP winding press technology — glass and carbon reinforced plastics
[DLR-IB-152-77/10] N78-18254
RELATIVISTIC PARTICLES
Graphical evaluation of relativistic matrix elements
[NASA-CR-155774] N78-18884
A simulation model for the FX-75 relativistic electron beam accelerator
N78-18895
RELATIVISTIC PLASMAS
Diagnosis of a relativistic nonneutral plasma column based on the synchrotron radiation spectrum, theory and experiment
N78-18922
RELAXATION TIME
Investigation of the T sub LL [T sub g] relaxation in homopolymers and block copolymers of styrene by torsional braid analysis
[AD-A048455] N78-18219
Relaxation of the bending mode of carbon dioxide by vibration to rotation and vibration to vibration energy transfer
N78-18951
RELIABILITY
Reliability, Improvement Warranty [RIW] mid contract evaluation
[AD-A048244] N78-18441
The decision table approach to reliable software
N78-18815
A goodness-of-fit test for a class of nonhomogeneous Poisson processes
[AD-A048180] N78-18844
RELIABILITY ANALYSIS
Cost and reliability aspects of large CMOS integrated circuits for fuzing applications
[AD-A048276] N78-18329
Reliability of welded joints and structures [selected articles]
[AD-A048336] N78-18442

Reliability evaluation of programmable read-only memories [PROMs], part 2
[AD-A048231] N78-18800
Software acquisition management guidebook: Verification
[AD-A048577] N78-18807
Network reliability analysis: Algorithms and complexity
N78-18863

REMOTE CONSOLES
Augmentation of a text retrieval system with an intelligent graphics terminal
[NPL-COM-86] N78-18980

REMOTE SENSORS
On the feasibility of monitoring soil moisture using active microwave remote sensing: An experimental evaluation
N78-18477
Earth Resources: A continuing bibliography with indexes, issue 15, October 1977
[NASA-SP-7041[15]] N78-18481
An example of appyling remote sensing to a Corps of Engineers archeological problem
[AD-A048106] N78-18503
Investigation of remote water-quality monitoring systems for use with GOES or ERTS water data transmitter
[AD-A047795] N78-18574
Methods for indirect wind measurement — laser and acoustic appliations
[DLR-IB-553-77/5] N78-18646

RENAL FUNCTION
Distinctions of fluid and electrolyte metabolism and renal function in crew members of the first Salyut-4 expedition
N78-18685

REPORTS
Satellite orbit computation methods
[NASA-CR-151600] N78-18096
Report presented to the 20th COSPAR General Assembly
N78-18616
NUSC technical publication guidelines
[AD-A048066] N78-18978

RESEARCH AIRCRAFT
A flight evaluation of a trailing anemometer for low-speed calibrations of airspeed systems on research aircraft
[NASA-TP-1135] N78-18044

RESEARCH AND DEVELOPMENT
Design of a blood-freezing system for leukemia research
[NASA-TP-1165] N78-18673

RESEARCH FACILITIES
NOAA/National Hurricane and Experimental Meteorological Laboratory
[NASA-CR-150550] N78-18627
SESAME/Environmental Research Laboratories
[NASA-CR-150551] N78-18628

RESEARCH MANAGEMENT
Research requirements to reduce maintenance costs of civil helicopters
[NASA-CR-145288] N78-17990
Test and evaluation for an air-launched guided missile program
[AD-A048675] N78-18100
Directions in US water research: 1978 - 1982
[PB-274278/1] N78-18511

RESEARCH PROJECTS
Applications of non-intrusive instrumentation in fluid flow research
[AGARD-AR-112] N78-18374
ERDA funding in transportation energy conservation area and research plans
N78-18553
Experimental measurements for the evaluation of the accuracy of tipping-bucket rain gauges used in the research program on radio propagation frequencies above 10 GHz
N78-18653

RESERVES
Other storage reserve report
[PB-273474/7] N78-18564

RESIDUAL STRESS
Residual stresses in an anisotropic thick hollow cylinder of chemically vapor-deposited material due to uniform cool-down
[AD-A048301] N78-18465

RESISTANCE THERMOMETERS
Resistance ratio/temperature relationships for industrial platinum resistance thermometers of thick film construction
[NPL-QU-42] N78-18407

RESONANCE
Low-speed impact phenomena and orbital resonances in the moon- and planet-building process
[NASA-CR-155310] N78-19016

RESONANT VIBRATION
High Q selective filters using mechanical resonance of silicon beams
N78-18304

RESONATORS
Four-point mounting configuration for resonators subjected to severe environments
[AD-A048069] N78-18326

RESOURCES MANAGEMENT
Principle characteristics of the National Earth Observation Satellite. Project SPOT
[NASA-TM-75081] N78-18492
Massachusetts coastal zone management program, volume I
[PB-274031/4] N78-18667

RESPIRATION
Mechanics of speech-related respiration while performing static physical exercise
N78-18726

RESPONSES
Defense reactions of the organism while breathing high concentrations of carbon dioxide
N78-18734
On the possibilities of on-line image restoration by means of a finite impulse response filter
[THT-TM-77-020] N78-18915

RESTORATION
On the possibilities of on-line image restoration by means of a finite impulse response filter
[THT-TM-77-020] N78-18915

RESUSCITATION
Medical support of the immediate postflight period following long space missions
N78-18741

RETROREFLECTION
Over-under double-pass interferometer
[NASA-CASE-NPO-13999-1] N78-18395

REVERSING
A note on the stability regions of the backwards differentiation methods
[TRITA-NA-7708] N78-18855

REYNOLDS NUMBER
Cylinder drag at low Reynolds number
N78-18347
Experimental and analytical study on the stability of a bounded jet at low Reynolds numbers
N78-18349
Three Dimensional and Unsteady Separation at High Reynolds Numbers
[AGARD-LS-94] N78-18375
Presentation of the subject
N78-18376
Inviscid fluid models, based on rolled-up vortex sheets, for three-dimensional separation at high Reynolds number
N78-18384
Status and future prospects of using numerical methods to study complex flows at high Reynolds numbers
N78-18388

REYNOLDS STRESS
Measured Reynolds stress tensors in a three-dimensional turbulent boundary layer
N78-18361

RHEOMETERS
Tetrapolar rheography used to evaluate the circulatory system
N78-18754

RIBONUCLEIC ACIDS
Cytochemical studies of proteins and RNA in individual spinal cord motoneurons and spinal ganglia neurons of rats following a space flight
N78-18744

RIDING QUALITY
Analytical study of ride smoothing benefits of control system configurations optimized for pilot handling qualities
[NASA-TP-1148] N78-18076

RIEMANN MANIFOLD
Convex riemannian manifolds of non-negative curvature
N78-18828

RIGID ROTORS
Aeromechanical stability of helicopters with a bearingless main rotor. Part 1: Equations of motion
[NASA-TM-78459] N78-18043

RING STRUCTURES
On continuous rings
N78-18870

RIVERS
New Castle County Delaware River shoreline study
[PB-275317/6] N78-18670

ROCKET ENGINES
The main propulsion system of the U.S. space shuttle. An example of the performance increase of propulsion systems of single stage launch rockets
[DLR-IB-76-3] N78-18110
Rocket gas generators - terrestrial use of space technology
[DLR-IB-456-76/9] N78-18121

ROCKS
Time dependent fault mechanics and wave propagation in rocks
N78-18603
Velocities of compressional wave in rocks of central California at high pressure and high temperature and applications to the study of the crustal structure of California coast ranges
N78-18606

RODS
Manufacturing methods and technology engineering for neodymium doped YAG laser rods
[AD-A048662] N78-18416

ROLL
Analytical model of a single axis attitude roll control system
[SAND-77-8256] N78-18164
The formation and stability of longitudinal roll vortices in shear flows
[AD-A048691] N78-18367

ROLLING CONTACT LOADS
Elastic-plastic analysis of a rolling disk by finite elements
N78-18455

ROTARY WINGS
Aeromechanical stability of helicopters with a bearingless main rotor. Part 1: Equations of motion
[NASA-TM-78459] N78-18043
Modern concepts for aerodynamic rotor design
[DLR-IB-151-77/11] N78-18058
Two-dimensional oscillating airfoil test apparatus
N78-19042

ROTATING DISKS
Elastic-plastic analysis of a rolling disk by finite elements
N78-18455

ROTATING PLASMAS
Interconnected linear theta pinches
[IPPJ-316] N78-18932

ROTATING SPHERES
The nonlinear response and stability of rotating shells
N78-18457

ROTOR AERODYNAMICS
Compressor and fan wake characteristics
[NASA-CR-155766] N78-17995
Application of system identification to analytic rotor modeling from simulated and wind tunnel dynamic test data
N78-18040
Modern concepts for aerodynamic rotor design
[DLR-IB-151-77/11] N78-18058

ROTOR BLADES [TURBOMACHINERY]
Investigation of the unsteady pressure distribution on the blades of an axial flow fan
[NASA-CR-15571] N78-18068

ROTORS
Application of system identification to analytic rotor modeling from simulated and wind tunnel dynamic test data
N78-18040

RUBBER
Effect of temperature and cross-linkings on the flow behavior of a rubberized epoxy resin
[UCRL-13732] N78-18220
Mathematical model for rubber hysteresis
N78-18450

RUBY LASERS
Electron number density measurement by ruby laser interferometry in a CO2 laser-induced gas breakdown plasma
[CONF-770725-1] N78-18938

RUNWAYS
Concepts for estimating capacity of basic runway configurations
[PB-274578/4] N78-18036
Concepts for determination of longitudinal separation standards on final approach
[PB-274590/9] N78-18038

RURAL AREAS
Size and composition of atmospheric particles in rural areas near Washington, D. C.
N78-18570

S

S MATRIX THEORY
Near-field antenna measurements on a cylindrical surface: A source scattering-Matrix formulation
[PB-274938/0] N78-18287

SAFETY
Safety methodology for space nuclear systems
[AD-A048780] N78-18898

SAFETY DEVICES
Fly-away restraint pin mechanism for the Army's PATRIOT missile system
N78-19030

SAFETY FACTORS
Technical and scientific aspects of sanitary and safety problems in nuclear energy production
[ISS-P-76/9] N78-18706

SAFETY MANAGEMENT
Engineering and development program plan: Wind shear
[AD-A048352] N78-18629

SALINITY
Use of LANDSAT-1 data for the detection and mapping of saline seeps in Montana
[E78-10074] N78-18483

SALTS
Use of LANDSAT-1 data for the detection and mapping of saline seeps in Montana
[E78-10074] N78-18483

SALYUT SPACE STATION
Technical characteristics and working conditions of long-term orbiting Salyut-type space stations
[NASA-TM-75058] N78-18097
Main results of medical research conducted during the flight of two crews on the Salyut-5 orbital station
N78-18684
Distinctions of fluid and electrolyte metabolism and renal function in crew members of the first Salyut-4 expedition
N78-18685
Studies of circulation during LBNP test aboard Salyut-4 orbital stations
N78-18719

SAMPLING
Trace elements in water: A development and application of sampling and sample handling procedures
N78-18571

SAN ANDREAS FAULT
Earthquake resistance of earth and rock-fill dams. Report 5: Permanent displacements of earth embankments by Newark sliding block analysis
[AD-A048346] N78-18610

SAN FRANCISCO [CA]
Ozone over San Francisco. Means and patterns during pollution episodes
[PB-274452/2] N78-18588

SANITATION
Spacecraft disinfectant/cleansing agent development
[NASA-CR-151628] N78-18212

SATELLITE ANTENNAS
Optimization of the design parameters for a wide-band radiometric system
[NASA-TM-78662] N78-18117
Pattern prediction of wire antennas on satellite structures
[AD-A048654] N78-18279
The geometrical theory of diffraction - a method for the solution of electromagnetic boundary value problems of complicated structures in the high frequency case — satellite and aircraft antennas
N78-18290
The integral equation method - a computational method for diffracted and scattered fields of complicated structures — satellite and aircraft antennas
N78-18291

SATELLITE ATTITUDE CONTROL
Magnetic bearing momentum wheels with magnetic gimballing capability for 3-axis active attitude control and energy storage
N78-19031
Development of a satellite flywheel family operating on one active axis magnetic bearings
N78-19043
Design and development of a solar array drive — a direct drive solar array pointing mechanism
N78-19046

SATELLITE DESIGN
Concepts for the realization of TV broadcasting satellite
N78-18103
Principle characteristics of the National Earth Observation Satellite. Project SPOT
[NASA-TM-75081] N78-18492

SATELLITE OBSERVATION
Optimization of the design parameters for a wide-band radiometric system
[NASA-TM-78662] N78-18117
Outline of the survey on the development of earth observation satellites
[NASA-TM-75065] N78-18491
Principle characteristics of the National Earth Observation Satellite. Project SPOT
[NASA-TM-75081] N78-18492
The Nimbus 6 data catalog. Volume 9: Data orbits 6803 through 7619, 1 November - 31 December 1976
N78-18631

SATELLITE ORBITS
Orbit determination and orbit prediction from measured data using the ELKORR program
[DLR-IB-552-76/10] N78-18094
Satellite orbit computation methods
[NASA-CR-151600] N78-18096
Improved LANDSAT to give better view of earth resources
[NASA-NEWS-RELEASE-78-22] N78-18480
Cumulative non-US standard catalog — LANDSAT imagery for 1976 - 1977
[NASA-TM-79359] N78-18509
Cumulative US standard catalog — LANDSAT imagery for 1976 - 1977
[NASA-TM-79358] N78-18510

SATELLITE SOLAR POWER STATIONS
AIAA/MSFC Symposium on Space Industrialization: Proceedings
[NASA-CP-2026] N78-18088

SATELLITE TRACKING
Rooftop antenna pointing program
[AD-A047999] N78-18111
Test facility for television sensors applied to the detection of satellites
[AD-A048189] N78-18112
A users guide to the GEODSS real-time system
[AD-A048300] N78-18113
Design for high accuracy critical-angle sun transit sensor
[AD-A048287] N78-18911

SATELLITE-BORNE INSTRUMENTS
Preliminary study of a data recorder with a magnetic bubble memory
[LETI/EPA/CRM-1248] N78-18405
The determination of symmetrical spherical harmonic distributions from limited data — member of satellite-borne particle telescopes
[ESA-TM-178] N78-18862

SATELLITE-BORNE PHOTOGRAPHY
Quick-look capability in a European earth resources satellite data network. Volume 2: Appendices 5 to 7
[FU15-4-VOL-2-APP-5-7] N78-18505
Cumulative US standard catalog — LANDSAT imagery for 1976 - 1977
[NASA-TM-79358] N78-18510

SCALE [CORROSION]
Investigation of magnetic water treatment devices -- - calcium carbonate scale retardation
N78-18987

SCALE MODELS
Effect of winglets on a first-generation jet transport wing. 4: Stability characteristics for a full-span model at Mach 0.30
[NASA-TP-1119] N78-17997
Effect of design changes on aerodynamic and acoustic performance of translating-centerbody sonic inlets
[NASA-TP-1132] N78-17998

SCALING LAWS
A scaling law for high density Tokamaks and its application to JIPP t-2 device
[IPPJ-318] N78-18934

SCANNING
Scanning and focusing mechanisms of METEOSAT radiometer
N78-19028

SCATTERING
Photopolarimetry of scattering surfaces and their interpretation by computer model
[NASA-CR-155305] N78-19013

SCATTERING CROSS SECTIONS
Electron scattering from vibrationally excited nitrogen
N78-18881
Studies in application of discrete ordinates transport methods to light transport calculations: Preparation of Mie theory cross sections in Legendre polynomials
[AD-A048614] N78-18913

SCATTEROMETERS
JSME scatterometer data processing
[NASA-CR-151639] N78-18494
A system analysis of the 13.3 GHz — antenna patterns and signal transmission
[NASA-CR-151627] N78-18496
A two-scale scattering model with application to the JONSWAP '75 aircraft microwave scatterometer experiment
[NASA-CR-2919] N78-18662

SCHEDULING
Concepts for estimating capacity of basic runway configurations
[PB-274578/4] N78-18036
Measuring the impact on scheduled air lines operations of restrictions in fuel availability
N78-18549

SCHLIEREN PHOTOGRAPHY
A system and method for obtaining wide screen schlieren photographs
[NASA-CASE-NPO-14174-1] N78-18396

SCHOTTKY DIODES
Small-signal characteristics of gallium arsenide Schottky-Read IMPATT diodes
N78-18300
Manufacturing methods and technology engineering high-efficiency, high-power gallium arsenide read-type IMPATT diodes, volume 2
[AD-A048579] N78-18334
Analysis of leak currents in field effect transistors with a submicron Schottky gate
[LCR-450/258] N78-18343

SCHROEDINGER EQUATION
A perturbation expansion for the nonlinear Schrodinger equation with application to the influence of nonlinear Landau damping
[IPPJ-315] N78-18931
Modulated langmuir waves and nonlinear Landau damping — Schroedinger equation
[IPPJ-319] N78-18935

SCREEN EFFECT
Investigation of aerodynamic characteristics of V-wings near solid surface
[AD-A048555] N78-18003

SCRUBBERS
Gas-atomized spray scrubber evaluation
[PB-274449/8] N78-18589

SEA WATER
The effects of velocity on corrosion of galvanic couples in seawater
[AD-A048669] N78-18191
Mixed layer observations during the NORPAX POLE experiment
[AD-A048581] N78-18664

SEARCH PROFILES
The search for extraterrestrial intelligence [SETI]
[NASA-SP-419] N78-18771
File organisation and access techniques. A selective bibliography
[BLL-BLRDR-5414-[2113.56F]]
N78-18981

SEATS
Selected design parameters for reclining seats based on engineering anthropometry
[AD-A048458] N78-18769

SEDIMENT TRANSPORT
Hydraulic sensor instrumentation of a shore face in a tidal current convergence zone: Cape Henry, Virginia
[PB-275247/5] N78-18671

SEDIMENTS
A feasibility study for the development of a nuclear moisture density measurement system for marine use
[AD-A048665] N78-18663

SEEPAGE
Use of LANDSAT-1 data for the detection and mapping of saline seeps in Montana
[E78-10074] N78-18483

SEISMIC WAVES
Time dependent fault mechanics and wave propagation in rocks
N78-18603

SELECTION
Guidelines for the selection and application of tantalum electrolytic capacitors in highly reliable equipment
[NASA-TM-X-64755-REV-A] N78-18311
On rules based on sample medians for selection of the largest location parameter
[AD-A047948] N78-18860

SELENIDES
Optical dispersion and electrical transport studies of iron intercalated zirconium diselenide
N78-18906

SELF FOCUSING
Focus drive mechanism for the IUE scientific instrument
N78-19045

SEMICONDUCTING FILMS
Epitaxial growth of semi-insulating GaAs
[AD-A048466] N78-18961

SEMICONDUCTOR DEVICES
Study of the physics of insulating films as related to the reliability of metal-oxide semiconductor devices
[AD-A048483] N78-18328
Modeling of high current injection into bipolar semiconductors
[AD-A048781] N78-18330
Semiconductor projectile impact detector
[NASA-CASE-MFS-23008-1] N78-18390

SEMICONDUCTORS [MATERIALS]
Semiconductor measurement technology: A versatile high-voltage bias supply for extended range MIS C[V] and G[V] measurements
[PB-274939/8] N78-18345
Electron transfer at sensitized semiconductor electrodes — photochemical reactions
N78-18949
Optically induced hot electron effects in semiconductors
[AD-A048194] N78-18956
Theory of surface polaritons in n-InSb in the presence of a DC current and an external DC magnetic field
[AD-A048217] N78-18959

SENSITIZING
Electron transfer at sensitized semiconductor electrodes — photochemical reactions
N78-18949

SEPARATED FLOW
Fundamental studies of subsonic and transonic flow separation. Part 2: Second phase summary report
[AD-A048615] N78-18007
The formation and stability of longitudinal roll vortices in shear flows
[AD-A048691] N78-18367
Three Dimensional and Unsteady Separation at High Reynolds Numbers
[AGARD-LS-94] N78-18375
Phenomenological aspects of quasi-stationary controlled and uncontrolled three-dimensional flow separations
N78-18380
Introduction to unsteady aspects of separation in subsonic and transonic flow
N78-18381
Prediction of separation using boundary layer theory
N78-18386
Prediction of unsteady separated flows on oscillating airfoils
N78-18387
Status and future prospects of using numerical methods to study complex flows at high Reynolds numbers
N78-18388

SEQUENCING
Synthesis of sequences for traffic signal controllers using techniques of the theory of graphs
[OUEL-1189/77] N78-18993
SET THEORY
A study of remote points of metric spaces
N78-18867
SEWAGE TREATMENT
Wastewater characterization and process reliability for potable wastewater reclamation
[PB-274874/7] N78-18992
Multimedium management of municipal sludge, volume 9
[PB-274093/4] N78-18998
Digital computer control of advanced waste treatment systems
[PB-274859/8] N78-18999
SHEAR FLOW
A numerical investigation of confined turbulent shear flows
N78-18356
The formation and stability of longitudinal roll vortices in shear flows
[AD-A048691] N78-18367
SHEAR LAYERS
Structure of turbulence in complex flows — shear layers
N78-18385
SHEAR STRAIN
Progress in structural bonding through effective bondline stress analysis
[DLR-IB-152-77/18] N78-18468
SHEAR STRESS
Progress in structural bonding through effective bondline stress analysis
[DLR-IB-152-77/18] N78-18468
SHELLS (STRUCTURAL FORMS)
The STAGS computer code
[NASA-CR-2950] N78-18458
Transient response of shells with internally attached structures
[AD-A048167] N78-18462
Dynamic response of a submerged elastic structure with elastic structures attached to it by inelastic springs
[AD-A048166] N78-18463
SHIELDING
Hemopoiesis in dogs exposed to lethal doses of protons with shielded bone marrow
N78-18728
SHIPS
Energy and economic impacts of projected freight transportation improvements
N78-18537
Oceanographic station data collected aboard R/V Melville during FDRAKE 75
[PB-274442/3] N78-18668
Prevention of hypertensive states in ship crews out at sea
N78-18759
SHOCK MEASURING INSTRUMENTS
Semiconductor projectile impact detector
[NASA-CASE-MFS-23008-1] N78-18390
SHOCK WAVES
Estimates of turbulent boundary layer behind a shock wave moving with uniform
[AD-A048445] N78-18369
Viscid-inviscid interaction methods for two-dimensional flows, including separation and shock waves
N78-18379
Transient response of shells with internally attached structures
[AD-A048167] N78-18462
Dynamic response of a submerged elastic structure with elastic structures attached to it by inelastic springs
[AD-A048166] N78-18463
SHORELINES
LANDSAT application of remote sensing to shoreline-form analysis — Cape Hatteras, Cape Lookout, and Assateague Island
[E78-10079] N78-18488
New Castle County Delaware River shoreline study
[PB-275317/6] N78-18670
SHORT TAKEOFF AIRCRAFT
Parametric transonic evaluation of type A VSTOL nacelle drag
[AD-A048110] N78-18002
The application of techniques for predicting STOL aircraft response to wind shear and turbulence during the landing approach
[UTIAS-215] N78-18077
SIGNAL PROCESSING
High speed micro signal processor study
[AD-A047997] N78-18322
Study to develop gradiometer techniques
[AD-A048252] N78-18609
An investigation of the bearing accuracy of two passive multi-channel array algorithms in the presence of correlated noise
N78-18791
Some applications of discrete analog signal processing to pattern recognition
N78-18818
SIGNAL TO NOISE RATIOS
An electro optical MTI system for the detection of artificial satellites [the NITH finder]
[AD-A048055] N78-18099
SIGNAL TRANSMISSION
A system analysis of the 13.3 GHz — antenna patterns and signal transmission
[NASA-CR-151627] N78-18496
SIGNATURES
Laser pulse speckle effects
[AD-A048598] N78-18421
SILICATES
Mechanisms and kinetics of binary alkali silicate glass corrosion
N78-18207
SILICON
High Q selective filters using mechanical resonance of silicon beams
N78-18304
Phase 1 of the automated array assembly task of the low cost silicon solar array project
[NASA-CR-155935] N78-18516
Hot forming of silicon sheet, silicon sheet growth development for the large area silicon sheet task of the low cost silicon solar array project
[NASA-CR-155934] N78-18517
Synthesis of silane and silicon in a non-equilibrium plasma jet
[NASA-CR-155933] N78-18518
Energy requirement for the production of silicon solar arrays
[NASA-CR-155932] N78-18519
Common module electro optical multiplexer developer
[AD-A048484] N78-18914
Electronic instability and change of crystalline phase in compounds of the V3Si type at low temperature
[NASA-TM-75178] N78-18953
Theory of bound states associated with n-type inversion layers on silicon
[AD-A048216] N78-18960
SILICON DIOXIDE
Silicon oxidation studied by electron spectroscopy
[LYCEN-7719] N78-18167
SILICON NITRIDES
Microwave techniques for nondestructive evaluation of ceramics
[AD-A048582] N78-18443
SILICON TETRACHLORIDE
A system for delivering SiCl4 to a chemical reactor
[NASA-CASE-NPO-14383-1] N78-18253
SILVER
Real-time computer optimized scanning potential coulometry for multi-component trace analysis
N78-18152
Diffusion in a temperature gradient
N78-18346
SIMULATION
Atmospheric simulation using stratified liquid models
[PB-274529/7] N78-18658
SIMULATORS
IUS/payload communication system simulator configuration definition study — payload simulator for pcm telemetry
[NASA-CR-151620] N78-18259
SIMULTANEOUS EQUATIONS
Time-dependent mathematical programs
[AD-A048428] N78-18852
SINGLE CRYSTALS
Thermal and electrical transport measurements in single crystal beryllium at low temperatures
N78-18952
SINGLE STAGE ROCKET VEHICLES
The main propulsion system of the U.S. space shuttle. An example of the performance increase of propulsion systems of single stage launch rockets
[DLR-IB-76-3] N78-18110
JASON laser propulsion study, summer 1977
[AD-A047901] N78-18412
SITES
Site dependent factors affecting the economic feasibility of solar powered absorption cooling
[NASA-CR-150533] N78-18524
SKIN FRICTION
Turbulent boundary layers over nonstationary plane boundaries
[NASA-TM-74091] N78-18358
SKYLAB PROGRAM
Earth Resources: A continuing bibliography with indexes, issue 15, October 1977
[NASA-SP-7041[15]] N78-18481
SLEEP
Sleep wakefulness determinations from heart rate data, volume 3
[AD-A045817] N78-18703
SLENDER BODIES
Some unsteady separation problems for slender bodies
N78-18383
SLIDING
Mathematical elaboration of the double sliding, free rotating model
N78-18236
SLIDING FRICTION
Thermoelastic phenomena in lubricated sliding contact
[AD-A047926] N78-18431
SLOTTED WIND TUNNELS
Design and performance evaluation of slotted walls for two-dimensional wind tunnels
[NASA-TM-78648] N78-18085
SLUDGE
Multimedium management of municipal sludge, volume 9
[PB-274093/4] N78-18998
SLUSH
The thermodynamic properties of slush hydrogen and oxygen
[NASA-CR-155743] N78-18168
SMOG
The occurrence of photochemical smog formation in western Europe
[IG-PUBL-597] N78-18583
Measurement of rate constants of importance in smog
[PB-274530/5] N78-18586
SMOOTHING
Filtering of non-linear instabilities
[NASA-CR-155779] N78-17996
SNOW
A snow index using 200 mb warm advection
[PB-275184/0] N78-18657
SOCIAL FACTORS
International transfer of marine technology, a three-volume study — social, political and economic factors
[PB-275353/1] N78-18986
SOIL MECHANICS
Earthquake resistance of earth and rock-fill dams. Report 5: Permanent displacements of earth embankments by Newark sliding block analysis
[AD-A048346] N78-18610
SOIL MOISTURE
On the feasibility of monitoring soil moisture using active microwave remote sensing: An experimental evaluation
N78-18477
SOILS
Spectral measurement of watershed coefficients in the southern Great Plains
[E78-10073] N78-18482
Application of remote sensing data to surveys of the Alaskan environment
[E78-10077] N78-18486
Investigations using data from LANDSAT 2 — Bangladesh
[E78-10080] N78-18489
SOLAR ACTIVITY
Solar-geophysical data number 397, September 1977. Part 1: Data for August - July 1977
[PB-274823/4] N78-19023
Solar-Geophysical data number 397, September 1977. Part 2: Data for March - February 1977 and miscellanea
[PB-274824/2] N78-19024
SOLAR ARRAYS
Phase 1 of the automated array assembly task of the low cost silicon solar array project
[NASA-CR-155935] N78-18516
Hot forming of silicon sheet, silicon sheet growth development for the large area silicon sheet task of the low cost silicon solar array project
[NASA-CR-155934] N78-18517
Energy requirement for the production of silicon solar arrays
[NASA-CR-155932] N78-18519
Thermal cycling tests on solar cell panel samples under vacuum conditions
[DLR-IB-353-77/1] N78-18563
Design and development of a solar array drive — a direct drive solar array pointing mechanism
N78-19046
SOLAR CELLS
Solar cell angular position transducer
[NASA-CASE-LAR-11999-1] N78-18394
A computer analysis of heterojunction and graded bandgap solar cells
N78-18512
Radiation effects on A1GaAs/GaAs solar cells using 0.9-3.0 MeV protons and 1.0-1.4 MeV electrons
[AD-A048037] N78-18557
Computer program for design and performance analysis of navigation-aid power systems. Program documentation. Volume 1: Software requirements document
[AD-A047925] N78-18558
Thermal cycling tests on solar cell panel samples under vacuum conditions
[DLR-IB-353-77/1] N78-18563
SOLAR COLLECTORS
Indoor thermal performance evaluation of Daystar solar collector
[NASA-CR-150511] N78-18521
Thermal performance of MSFC hot air collectors under natural and simulated conditions
[NASA-CR-150506] N78-18525
Solafern solar system design brochure
[NASA-CR-150515] N78-18526
Focusing solar collector development
[PB-275042/0] N78-18561

A low cost high temperature sun tracking solar energy collector N78-19041
SOLAR ENERGY
Solar energy storage subsystem utilizing latent heat of phase change N78-18513
Stochastic models of solar energy systems N78-18514
Energy requirement for the production of silicon solar arrays [NASA-CR-155932] N78-18519
Focusing solar collector development [PB-275042/0] N78-18561
State solar energy legislation of 1976: A review of statutes relating to buildings [PB-273899/5] N78-18567
SOLAR ENERGY CONVERSION
A computer analysis of heterojunction and graded bandgap solar cells N78-18512
Indoor thermal performance evaluation of Daystar solar collector [NASA-CR-150511] N78-18521
Solafern solar system design brochure [NASA-CR-150515] N78-18526
Preliminary analysis of an option for the Federal photovoltaic utilization program [PB-274220/3] N78-18562
Ocean thermal energy conversion: Legal, political, and institutional aspects [PB-274123/9] N78-18568
SOLAR GENERATORS
Site dependent factors affecting the economic feasibility of solar powered absorption cooling [NASA-CR-150533] N78-18524
SOLAR HEATING
Stochastic models of solar energy systems N78-18514
Solafern solar system design brochure [NASA-CR-150515] N78-18526
SIMS prototype system 1 test results: Engineering analysis [NASA-CR-150522] N78-18527
SOLAR RADIATION
Mixed layer observations during the NORPAX POLE experiment [AD-A048581] N78-18664
SOLAR SENSORS
Design for high accuracy critical-angle sun transit sensor [AD-A048287] N78-18911
A low cost high temperature sun tracking solar energy collector N78-19041
SOLAR SYSTEM
Equal period orbit determination for the solar system planets [NASA-TM-78156] N78-18092
SOLID PROPELLANT IGNITION
Use of fluid injection to regulate the combustion chamber pressure for unstably burning solid propellant combustion [DLR-IB-456-77/4] N78-18124
SOLID PROPELLANT ROCKET ENGINES
Hybrid propulsive systems: Technology and application [DLR-IB-456-76/11] N78-18126
SOLID PROPELLANTS
Boron combustion in combinatory propulsion [DLR-IB-456-77/8] N78-18229
SOLID SOLUTIONS
Thermodynamic properties of U[C,N] solid solutions and derived relationships among Thermodynamic excess properties N78-18963
SOLID SURFACES
Investigation of aerodynamic characteristics of V-wings near solid surface [AD-A048555] N78-18003
High-speed fabrication of aspherical surfaces — for optical equipment N78-18900
SOLIDS
Calculations of the optical properties of laser-induced plasmas in solid bodies — laser weapons target acquisition [DLR-IB-551-77/6] N78-18943
Solid phase epitaxial growth [AD-A048261] N78-18955
SOLITARY WAVES
Reflection and refraction of solitary waves: A numerical investigation N78-18659
Soliton and generation of cloud in nonlinear dispersive media with weak dissipation [IPPJ-312] N78-18928
SOLUTES
Studies of atoms vaporized from individual solute particles in analytical flames N78-18150
SOUND DETECTING AND RANGING
Methods for indirect wind measurement — laser and acoustic appliations [DLR-IB-553-77/5] N78-18646
SOUND WAVES
Interaction of electromagnetic and acoustic waves in a stochastic atmosphere [NASA-CR-155746] N78-18275
SOYUZ SPACECRAFT
Measurement of radiation doses in the Soyuz-16 spacecraft N78-18732
Dynamics of cyclic and acyclic locomotion of the Soyuz-18 crew after a 63-day space mission N78-18740
SPACE CHARGE
Coupling of electromagnetic waves and space charge waves in type O traveling wave tubes [NASA-TM-75249] N78-18309
SPACE ENVIRONMENT SIMULATION
Guidelines for the simulation of the degradation of surface properties under combined UV/particle radiation [ESA-PSS-37/QRM-06T-ISSUE-1] N78-18444
SPACE FLIGHT
Carbohydrate and lipid content of rat liver tissue following a 22-day space flight N78-18755
SPACE FLIGHT STRESS
Change in gravitation level as a stress factor N78-18683
Space Biology and Aerospace Medicine, no. 3, 1977 [JPRS-69380] N78-18715
Experimental and general theoretical research N78-18717
Distinctive features of regional circulation and vasomotor regulation following a two-month space flight N78-18718
Dynamics of orthostatic stability of cosmonauts following 2 to 63 day missions N78-18720
Some psychoneurological requirements in assessing inflight functional state of cosmonauts N78-18721
Histochemical study of digestive organs of rats following flight on Kosmos-605 N78-18722
Dynamics of cyclic and acyclic locomotion of the Soyuz-18 crew after a 63-day space mission N78-18740
Medical support of the immediate postflight period following long space missions N78-18741
DNA status in rat liver and spleen following flight on Kosmos-605 satellite N78-18742
Effect of prolonged space flight on protein biosynthesis in various rat organs and tissues N78-18743
Cytochemical studies of proteins and RNA in individual spinal cord motoneurons and spinal ganglia neurons of rats following a space flight N78-18744
Vestibulotonic reflexes in muscles of the rat hind limb following a flight on Kosmos-605 N78-18745
Effect of prolonged hypokinesia on the course of acute aseptic inflammation N78-18747
SPACE MANUFACTURING
AIAA/MSFC Symposium on Space Industrialization: Proceedings [NASA-CP-2026] N78-18088
The next 25 years: Industrialization of space: Rationale for planning [NASA-TM-79360] N78-18091
SPACE MISSIONS
Otolith system function in cosmonauts following space missions N78-18736
Medical support of the immediate postflight period following long space missions N78-18741
SPACE PROCESSING
AIAA/MSFC Symposium on Space Industrialization: Proceedings [NASA-CP-2026] N78-18088
Planning for Materials Processing in Space [NASA-CR-155786] N78-18090
The next 25 years: Industrialization of space: Rationale for planning [NASA-TM-79360] N78-18091
SPACE RENDEZVOUS
Ion Propulsion Module [IPM] technology readiness assessment: 1985 Halley's Comet rendezvous mission [NASA-CR-155308] N78-18120
SPACE SHUTTLE ORBITERS
IUS prerelease alinement [NASA-TM-79349] N78-18104
An introduction to shuttle/LDEF retrieval operations: The R-bar approach option — orbital mechanics and braking schedule [NASA-TM-78668] N78-18105
Space shuttle, 1978 [GPO-99-072] N78-18106
SPACE SHUTTLES
Technical characteristics and working conditions of long-term orbiting Salyut-type space stations [NASA-TM-75058] N78-18097
Space shuttle, 1978 [GPO-99-072] N78-18106
The main propulsion system of the U.S. space shuttle. An example of the performance increase of propulsion systems of single stage launch rockets [DLR-IB-76-3] N78-18110
Space shuttle proximity operation sensor study [NASA-CR-151634] N78-18118
IUS/payload communication system simulator configuration definition study — payload simulator for pcm telemetry [NASA-CR-151620] N78-18259
Design and development of the Space Shuttle tail service masts N78-19027
SPACE STATIONS
AIAA/MSFC Symposium on Space Industrialization: Proceedings [NASA-CP-2026] N78-18088
A space necklace about the earth [NASA-TM-75174] N78-18089
SPACE SUITS
Emergency space-suit helmet [NASA-CASE-MSC-10954-1] N78-18761
Spacesuit mobility joints [NASA-CASE-ARC-11058-2] N78-18763
SPACE SURVEILLANCE (GROUND BASED)
A star scene simulator for test and evaluation of imaging systems used in point-source detection [AD-A048201] N78-18095
SPACE SURVEILLANCE (SPACEBORNE)
An electro optical MTI system for the detection of artificial satellites (the NITH finder) [AD-A048055] N78-18099
Test facility for television sensors applied to the detection of satellites [AD-A048189] N78-18112
A users guide to the GEODSS real-time system [AD-A048300] N78-18113
SPACE TRANSPORTATION
AIAA/MSFC Symposium on Space Industrialization: Proceedings [NASA-CP-2026] N78-18088
A space necklace about the earth [NASA-TM-75174] N78-18089
Preliminary design study of a propulsion platform for transport of Spacelab payloads — chemical propulsion [DLR-IB-456/76-6] N78-18107
USAP - a universal standardized propulsion platform for the transport of Spacelab payloads [DLR-IB-456/75-9] N78-18123
SPACE-TIME FUNCTIONS
Space-time evolution of nonlinear three-wave interactions N78-18257
SPACEBORNE PHOTOGRAPHY
Cumulative non-US standard catalog — LANDSAT imagery for 1976 - 1977 [NASA-TM-79359] N78-18509
SPACEBORNE TELESCOPES
Focus drive mechanism for the IUE scientific instrument N78-19045
SPACECRAFT CABIN ATMOSPHERES
Dynamic control of parameters of spacecraft atmosphere N78-18725
SPACECRAFT COMMUNICATION
IUS/payload communication system simulator configuration definition study — payload simulator for pcm telemetry [NASA-CR-151620] N78-18259
SPACECRAFT CONFIGURATIONS
SEAP - configuration and cost analysis — Spacelab experiment propulsion platform [DLR-IB-456-77/2] N78-18108
SPACECRAFT CONSTRUCTION MATERIALS
Guidelines for space materials selection [ESA-PSS-07/QRM-01-ISSUE-3] N78-18116
SPACECRAFT DOCKING
Docking and retrieval mechanism N78-19036
SPACECRAFT ENVIRONMENTS
Spacecraft disinfectant/cleansing agent development [NASA-CR-151628] N78-18212
Space Biology and Aerospace Medicine, no. 5, 1977 [JPRS-70135] N78-18679
SPACECRAFT INSTRUMENTS
Wear-resistant ball bearings for space applications N78-19038
SPACECRAFT LAUNCHING
Improved LANDSAT to give better view of earth resources [NASA-NEWS-RELEASE-78-22] N78-18480
Cartridge firing device designed for attachment, release and ejection of a satellite N78-19033

SPACECRAFT LUBRICATION
Positive commandable oiler for satellite bearing lubrication
N78-19035

SPACECRAFT ORBITS
Equal period orbit determination for the solar system planets
[NASA-TM-78156] N78-18092

SPACECRAFT PROPULSION
JASON laser propulsion study, summer 1977
[AD-A047901] N78-18412

SPACECRAFT STABILITY
An active nutation damper for spacecraft
N78-19039

SPACECRAFT STRUCTURES
Third Conference on Fibrous Composites in Flight Vehicle Design, part 2
[NASA-TM-X-3377-PT-2] N78-18134
Design and development of the Space Shuttle tail service masts
N78-19027
Magnetometer deployment mechanism for Pioneer Venus
N78-19029

SPACELAB
SEAP: A Spacelab experiments propulsive platform for the transport of Spacelab payloads. First study results
[DLR-IB-456-76/1] N78-18109
Experiences with the ASSESS 2 lidar experiment
[DLR-IB-553-77/6] N78-18296

SPACELAB PAYLOADS
Preliminary design study of a propulsion platform for transport of Spacelab payloads — chemical propulsion
[DLR-IB-456/76-6] N78-18107
SEAP - configuration and cost analysis — Spacelab experiment propulsion platform
[DLR-IB-456-77/2] N78-18108
USAP - a universal standardized propulsion platform for the transport of Spacelab payloads
[DLR-IB-456/75-9] N78-18123

SPARK CHAMBERS
An electric current preamplifier associated to the cathodic planes of proportional multiwire chambers
[LYCEN-7705] N78-18342

SPARK IGNITION
Performance characteristics of automotive engines in the United States. Report no. 10: Chevrolet [1975] 250 CID 1-bbl engine
[PB-274376/3] N78-18439

SPATIAL DISTRIBUTION
Studies of atoms vaporized from individual solute particles in analytical flames
N78-18150

SPECIFIC IMPULSE
Rocket stage mass model for performance prediction
[DLR-IB-456-75/8] N78-18115

SPECIFICATIONS
Guidelines for space materials selection
[ESA-PSS-07/QRM-01-ISSUE-3]
N78-18116
A production engineering measure for two L-band solid state microwave frequency sources
[AD-A047903] N78-18315

SPECKLE PATTERNS
Specklegram data reduction using optical and digital techniques
[AD-A048210] N78-18907

SPECTRAL ENERGY DISTRIBUTION
Parameter studies relative to an electric field-induced dipole moment laser
[AD-A048327] N78-18417

SPECTRAL SIGNATURES
Spectral measurement of watershed coefficients in the southern Great Plains
[E78-10073] N78-18482
Use of LANDSAT-1 data for the detection and mapping of saline seeps in Montana
[E78-10074] N78-18483
Selection of a seventh spectral band for the LANDSAT-D thematic mapper
[E78-10078] N78-18487

SPECTROGRAPHS
The development of a parallel-channel spectrographic detector: Applications to Raman scattering
N78-18903

SPECTROMETERS
Atomic fluorescence flame spectrometry with a continuous wave dye laser
N78-18409

SPECTROPHOTOMETRY
Significant achievements in the planetary program, 1976 - 1977
[NASA-CR-2956] N78-19022

SPECTROSCOPIC ANALYSIS
Structure elucidation by nuclear magnetic resonance spectroscopy — bisbenzylisoquinoline alkaloids
N78-18145
Silicon oxidation studied by electron spectroscopy
[LYCEN-7719] N78-18167
A spectroscopic investigation of the Be binary system phi Persei
N78-19011
Lunar sample analysis
[NASA-CR-151618] N78-19021

SPECTROSCOPY
Matrix isolation fluorescence spectroscopy of polycyclic aromatic hydrocarbons
N78-18147

SPECTRUM ANALYSIS
Simultaneous kinetic and spectral analysis using a vidicon rapid-scanning stopped-flow spectrometer
N78-18155
A computer program for analyzing unresolved Moosbauer hyperfine spectra
[NASA-TM-78633] N78-18796
The 16 to 40 micron spectra of Jupiter and Venus — far infrared absorption of hydrogen and sulfuric acid
N78-19008

SPEECH
Mechanics of speech-related respiration while performing static physical exercise
N78-18726

SPHERICAL HARMONICS
The determination of symmetrical spherical harmonic distributions from limited data — member of satellite-borne particle telescopes
[ESA-TM-178] N78-18862

SPHEROIDS
Analytical solution of the generalized Helmholtz wave equation for compressible subsonic flow and calculation of the unsteady pressure distributions about oscillating spheroids
[ESA-TT-421] N78-18017

SPIN DYNAMICS
Formal and computational studies of molecular collision dynamics
N78-18880

SPINAL CORD
Cytochemical studies of proteins and RNA in individual spinal cord motoneurons and spinal ganglia neurons of rats following a space flight
N78-18744

SPLEEN
DNA status in rat liver and spleen following flight on Kosmos-605 satellite
N78-18742

SPREAD SPECTRUM TRANSMISSION
A theoretical investigation of spread spectrum modulation concepts and performance
N78-18258

SPRINGS [ELASTIC]
Dynamic response of a submerged elastic structure with elastic structures attached to it by inelastic springs
[AD-A048166] N78-18463

SPRINT MISSILE
The conception, birth, and growth of a missile umbilical system
N78-19044

SPUTTERING
Effect of surface texture by ion beam sputtering on implant biocompatibility and soft tissue attachment
[NASA-CR-135311] N78-18672

STABILITY
Preliminary tests of inflatable liferafts for stability in high winds
[AD-A048722] N78-18023
Special evaluation for pedestal-level stability of height-finder radars on temperate towers
[AD-A048604] N78-18284
The application of invariant imbedding to problems in elastic stability
N78-18453
A note on the stability regions of the backwards differentiation methods
[TRITA-NA-7708] N78-18855

STABILITY TESTS
Resistance strain gages for stability experiments at temperatures up to 300 deg C
[NASA-TM-75246] N78-18392

STAGE SEPARATION
An application of interactive computer graphics technology to the design of dispersal mechanisms
N78-19032

STAGNATION POINT
Ignition criteria for non-premixed stagnation point flow
N78-18352

STANDARDIZATION
National Bureau of Standards Journal of Research, section A: Physics and Chemistry, volume 81A, numbers 2 and 3, March - June 1977
[PB-275037/0] N78-18169
Modular packaging approaches
[AD-A048205] N78-18321
NBS type 4 RF power meter operation and maintenance
[PB-274456/3] N78-18402

STANDARDS
Current standards of fatigue test on strike aircraft
[AGARD-AR-92] N78-18051
The national measurement system for radiometry and photometry
[PB-274643/6] N78-18256
Activities of the Quantum Metrology Division
[NPL-QU-AR75] N78-18973

STAR TRACKERS
A low cost high temperature sun tracking solar energy collector
N78-19041

STARK EFFECT
A study of stark broadening of high-z hydrogenic ion lines in dense hot plasmas
N78-18925

STATIC PRESSURE
Two-dimensional transonic testing with splitter plates
[NASA-TP-1153] N78-17999

STATIC STABILITY
The STAGS computer code
[NASA-CR-2950] N78-18458

STATISTICAL ANALYSIS
Statistical model for asperity-contact time fraction in elastohydrodynamic lubrication
[NASA-TP-1130] N78-18429
Numerical methods for the statistical analysis of random processes by means of computers
[NASA-TT-F-17159] N78-18795
Constraints in the design and implementation of interactive statistical systems for minicomputers
[AD-A048124] N78-18803
Generalized stochastic network and statistical decision analysis
N78-18856

STATISTICAL DECISION THEORY
Statistical estimation theory applied to synchronous generator modeling
N78-18306

STATISTICAL WEATHER FORECASTING
Survey: National Meteorological Center
[NASA-CR-150549] N78-18626
Practical use of transitional rules for forecasting the monthly mean temperature at De Bilt
[KNMI-V-290] N78-18648

STEADY FLOW
Archives of mechanics, volume 29, issue 4
N78-18231
Equations of steady flow through slightly curved multifilament bundles
N78-18233

STEAM
The design and evaluation of a two-phase turbine for low quality steam-water mixtures
N78-18426

STEAM TURBINES
Equations for approximating the thermodynamic data of a hydrogen/oxygen steam generator — exhaust gas temperature and characteristic velocity
[DLR-IB-456-77/9] N78-18964

STEEL STRUCTURES
Fabrication of pressure tank using HY-100 steel
[AD-A048767] N78-18433

STEELS
Mechanism of cleavage fracture in pearlitic eutectoid steel
N78-18176
Nondestructive inspection of steel, phase 1
[PB-274495/1] N78-18445
Experiments on dynamic plastic loading on frames
[AD-A048687] N78-18464

STELLAR ATMOSPHERES
Report presented to the 20th COSPAR General Assembly
N78-18616

STELLAR SPECTROPHOTOMETRY
A practical Hadamard spectrometer for astronomical application
N78-19007

STELLAR STRUCTURE
A spectroscopic investigation of the Be binary system phi Persei
N78-19011

STELLAR WINDS
The interaction of a strong stellar wind with the interstellar medium
N78-19015

STIFFNESS
Stiffness and damping of elastomeric O-ring bearing mounts
[NASA-CR-135328] N78-18460

STOCHASTIC PROCESSES
Stochastic models of solar energy systems
N78-18514
Generalized stochastic network and statistical decision analysis
N78-18856
Network reliability analysis: Algorithms and complexity
N78-18863
Concept and use of models, part 1 and part 2
[AD-A048594] N78-18865
Non-stochastic heating of magnetized plasma by electrostatic wave
[IPPJ-314] N78-18930

STOICHIOMETRY
Research on martensitic transformations in iron alloys
[AD-A047940] N78-18189

STORMS [METEOROLOGY]
Real-time computer techniques in the detection and analysis of severe storms from digital radar data
N78-18622
National Severe Storms Forecast Center
[NASA-CR-150547] N78-18625
Comparison of developing versus non-developing tropical disturbance
[AD-A047780] N78-18632
STRAIN GAGES
Resistance strain gages for stability experiments at temperatures up to 300 deg C
[NASA-TM-75246] N78-18392
Attaching of strain gages to substrates
[NASA-CASE-FRC-10093-1] N78-18393
STRAIN RATE
Theoretical studies of cyclic straining in polycrystalline metal plasticity
N78-18454
STRAPS
Drop foot corrective device
[NASA-CASE-LAR-12259-1] N78-18762
STRATIFICATION
An examination of combined free and forced convection phenomena in a density-stratified fluid
N78-18353
Evaluation of circulation in partially stratified estuaries as typified by the Hudson River
N78-18476
Atmospheric simulation using stratified liquid models
[PB-274529/7] N78-18658
STRATOSPHERE
Stratospheric warmings: Synoptic, dynamic and general-circulation aspects
[NASA-TP-1017] N78-18630
Venus stratospheric circulation: A diagnostic study
N78-19019
STRESS [PHYSIOLOGY]
Space Biology and Aerospace Medicine, no. 3, 1977
[JPRS-69380] N78-18715
STRESS [PSYCHOLOGY]
Space Biology and Aerospace Medicine, no. 3, 1977
[JPRS-69380] N78-18715
STRESS ANALYSIS
Calculation methods for fatigue life and crack propagation
N78-18049
Stress fields in composite laminates
[AD-A048565] N78-18139
Strength analysis of brittle materials
[AD-A048188] N78-18215
Experimental and theoretical stress analysis of a fiber reinforced plastic tensile specimen with a hole in it
[ESA-TT-417] N78-18223
Preliminary experiment on acoustoelasticity for stress analysis
N78-18244
A theory for longitudinal wave propagation in a composite rod: A model for linear elastodynamic behavior of composite penetrators
[AD-A048552] N78-18285
Stress and vibration analysis of orthotropic shells of revolution
N78-18449
Nonlinear dynamic analysis of flat plate layered bodies accounting for large transverse deflections
N78-18452
NASTRAN stress recovery package
[AD-A048744] N78-18467
Progress in structural bonding through effective bondline stress analysis
[DLR-IB-152-77/18] N78-18468
STRESS CONCENTRATION
Biaxial testing of graphite/epoxy composites containing stress concentrations, part 2
[AD-A048659] N78-18140
Elastic-plastic analysis of a rolling disk by finite elements
N78-18455
STRESS CORROSION CRACKING
Stress corrosion and repassivation behavior of austenitic stainless steels in boiling MgCl2 solution
[ESA-TT-437] N78-18204
Chemical degradation and stress-cracking of drawn poly[ethylene terephthalate] fibers
N78-18209
STRESS TENSORS
Measured Reynolds stress tensors in a three-dimensional turbulent boundary layer
N78-18361
STRESS-STRAIN RELATIONSHIPS
Tensile stress-strain behavior of boron/aluminum laminates
[NASA-TP-1117] N78-18135
STRUCTURAL ANALYSIS
The effects of external stores on the flutter of a non-uniform cantilever
[AD-A048360] N78-18078
Effect of drawing atmosphere on surface characteristics of glass fibers
N78-18208
Model laws for granular media and powders with a special view to silo models
N78-18235
The STAGS computer code
[NASA-CR-2950] N78-18458
Hybrid structures of revolution
[AD-A047982] N78-18461
Finite element capabilities in MIT Lincoln Laboratory version of STRUDL
[AD-A048605] N78-18466
NASTRAN stress recovery package
[AD-A048744] N78-18467
STRUCTURAL DESIGN
Substructuring methods for design sensitivity analysis and structural optimization
N78-18230
An RC active filter design handbook
[NASA-SP-5104] N78-18312
Designing holographic optical elements
N78-18389
STRUCTURAL ENGINEERING
Strength analysis of brittle materials
[AD-A048188] N78-18215
STRUCTURAL MEMBERS
Experiments on dynamic plastic loading on frames
[AD-A048687] N78-18464
STRUCTURAL STRAIN
The plane-strain general yielding of notched members due to combined axial force and bending. Volume 2: Deep circular notches
[OUEL-1210/77-VOL-2] N78-18473
STRUCTURAL VIBRATION
Concorde noise-induced building vibrations John F. Kennedy International Airport
[NASA-TM-78660] N78-18873
SUBSONIC FLOW
Fundamental studies of subsonic and transonic flow separation. Part 2: Second phase summary report
[AD-A048615] N78-18007
Analytical solution of the generalized Helmholtz wave equation for compressible subsonic flow and calculation of the unsteady pressure distributions about oscillating spheroids
[ESA-TT-421] N78-18017
Subsonic gas target 14 MeV neutron generator
N78-18896
SUBSONIC SPEED
A method for calculation of the pressure distribution of wing-body configurations for large angle of attack at subsonic speed — based on potential theory
[BMVG-FBWT-77-15] N78-18013
SUBSTRATES
Attaching of strain gages to substrates
[NASA-CASE-FRC-10093-1] N78-18393
Investigation of concomitant microflora in prolonged substrate-free cultivation of beet plants
N78-18729
SUBSTRUCTURES
Substructuring methods for design sensitivity analysis and structural optimization
N78-18230
SULFATES
Determination of optical constants of phosphates, sulphates and ammonia and related compounds in the near infrared region
[AD-A048173] N78-18908
SULFUR
Preliminary evaluation of sulfur variability in low-sulfur coals from selected mines
[PB-275000/8] N78-18566
SULFUR DIOXIDES
Improvements to single-source model. Volume 3. Further analysis of modeling results
[PB-274527/1] N78-18593
SULFURIC ACID
The 16 to 40 micron spectra of Jupiter and Venus — far infrared absorption of hydrogen and sulfuric acid
N78-19008
SUMMARIES
EHF transfer and shielding properties of air: Summary of 1974-1977 activities
[AD-A048067] N78-18277
SUPERCONDUCTING MAGNETS
Design of superconducting toroidal magnet coils and testing facility in the USA
[CONF-770842-5] N78-18340
SUPERCRITICAL WINGS
Collection of supercritical aerofoils obtained with the NLR hodograph method
[NLR-TR-75115-U] N78-18009
SUPERFLUIDITY
Neutron star crust-neutron superfluid frictional forces
N78-19010
SUPERHIGH FREQUENCIES
Manufacturing methods and technology engineering high-efficiency, high-power gallium arsenide read-type IMPATT diodes, volume 1
[AD-A048578] N78-18335
Experimental measurements for the evaluation of the accuracy of tipping-bucket rain gauges used in the research program on radio propagation frequencies above 10 GHz
N78-18653
SUPERSONIC AIRCRAFT
A procedure for the determination of the effect of fuselage nose bluntness on the wave drag of supersonic cruise aircraft
[NASA-CR-145306] N78-17994
SUPERSONIC CRUISE AIRCRAFT RESEARCH
Theoretical evaluation of high speed aerodynamics for arrow wing configurations
[NASA-TM-78659] N78-17992
SUPERSONIC FLOW
Design and calibration of 5-point conical pressure probes for measuring in supersonic flow
[DLR-FB-77-28] N78-18015
Forebody and afterbody solutions of the Navier-Stokes equations for supersonic flow over blunt bodies in a generalized orthogonal coordinate system
[NASA-TP-1075] N78-18362
Introduction to unsteady aspects of separation in subsonic and transonic flow
N78-18381
SUPPORTS
The mount performance of the second GEODSS telescope
[AD-A048745] N78-18912
SUPPRESSORS
Cable strumming suppression
[AD-A047996] N78-18366
SURFACE DISTORTION
Full-field determination of the first derivative of normal surface displacement of thin plates using speckle photographic interferometry
N78-18446
Effects of vertical distortion on thermalhydraulic modeling of surface discharges
N78-18479
SURFACE ENERGY
Theory of surface polaritons in n-InSb in the presence of a DC current and an external DC magnetic field
[AD-A048217] N78-18959
SURFACE FINISHING
Characterization of chromic-acid anodized 2024-T3 aluminum adherends
[AD-A048756] N78-18199
High-speed fabrication of aspherical surfaces — for optical equipment
N78-18900
Chemically polished quartz — using ammonium bifluoride
[AD-A048077] N78-18958
SURFACE PROPERTIES
Effect of drawing atmosphere on surface characteristics of glass fibers
N78-18208
Guidelines for the simulation of the degradation of surface properties under combined UV/particle radiation
[ESA-PSS-37/QRM-06T-ISSUE-1]
N78-18444
Photopolarimetry of scattering surfaces and their interpretation by computer model
[NASA-CR-155305] N78-19013
SURFACE REACTIONS
Gas surface interactions — recombination reactions with tungsten and platinum
[AD-A048667] N78-18160
The treatment of cellulose by high pressure discharge — molecular structure modifications
N78-18221
SURFACE ROUGHNESS
A review of theories for the fluid dynamic effects of roughness on laminar lubricating films
[AD-A048333] N78-18217
SURFACE TEMPERATURE
A physically based climate model of hemispheric mean surface temperature with predictive capability
N78-18620
Sea surface temperature determination from infrared radiation. A critical evaluation of the method — coastal water circulation study
[KNMI-WR-77-5] N78-18669
SURFACTANTS
The removal of 2, 4, 6-trinitrotoluene [TNT] from aqueous solution with surfactants
[AD-E400020] N78-18577
SURGES
Peculiarities of the initial stage of a transient in a cryogenic system
N78-18250
SURVEILLANCE RADAR
A clutter map for a phased array radar system
[FFM-247] N78-18293
SURVEYS
Survey of ceramic refractory problems and materials shortages
[AD-A048108] N78-18216
Survey: Automated Field Operations and Services [AFOS]
[NASA-CR-150548] N78-18261
Survey: National Meteorological Center
[NASA-CR-150549] N78-18626

SWEPT WINGS
Influence of wing tapering on the development of a three-dimensional turbulent boundary layer exemplified with a transonic wing
[BMVG-FBWT-77-7] N78-18010
Application and comparison of modal perturbation methods and modal correction procedures exemplified by a swept wing with two external stores
[DLR-FB-77-21] N78-18014
A simple finite difference technique for the computation of three-dimensional incompressible laminar boundary layers. Part 1: Description of the method
[NLR-TR-76086-U] N78-18371

SWITCHING CIRCUITS
Window comparator
[NASA-CASE-FRC-10090-1] N78-18308

SYNCHRONOUS EARTH OBSERVATORY SATELLITE
On the development of earth observation satellite systems
[NASA-TM-75064] N78-18490

SYNCHRONOUS SATELLITES
Survey: National Environmental Satellite Service
[NASA-CR-150546] N78-18098

SYNCHROTRON RADIATION
Diagnosis of a relativistic nonneutral plasma column based on the synchrotron radiation spectrum, theory and experiment
N78-18922

SYNTHETIC ARRAYS
Synthetic aperture radar image processing techniques development and evaluation
[AD-A048193] N78-18269

SYNTHETIC FUELS
Synthetic liquid fuels development: Assessment of critical factors
N78-18535

SYNTHETIC RESINS
Toxicity of pyrolysis gases from synthetic polymers
[NASA-TM-78458] N78-18127

SYSTEM FAILURES
Optimal data storage and organization in computerized information processing systems subject to failures
N78-18974

SYSTEMS ANALYSIS
A system analysis of the 13.3 GHz — antenna patterns and signal transmission
[NASA-CR-151627] N78-18496
Theory of tearing and its application to large-scale systems
N78-18813
Applications of pattern recognition and learning controllers to power system analysis and control
N78-18819
Concept and use of models, part 1 and part 2
[AD-A048594] N78-18865

SYSTEMS ENGINEERING
F-15/nonaxisymmetric nozzle system integration study support program
[NASA-CR-135252] N78-18070
Planning for Materials Processing in Space
[NASA-CR-155786] N78-18090
Survey: Automated Field Operations and Services [AFOS]
[NASA-CR-150548] N78-18261
Notes on design of high efficiency beam dividers for two beam infra-red interferometers
[NPL-QU-41] N78-18406
System design package: Maxi-therm S-101 heating module, passive heat exchanger
[NASA-CR-150516] N78-18522
Installation package - SIMS prototype system 1A
[NASA-CR-150524] N78-18523
SIMS prototype system 1 test results: Engineering analysis
[NASA-CR-150522] N78-18527
Energy intensity of various transportation modes
N78-18555
Generalized stochastic network and statistical decision analysis
N78-18856
What the next decade is going to bring
[NASA-TM-79361] N78-18976

SYSTEMS MANAGEMENT
Survey: National Environmental Satellite Service
[NASA-CR-150546] N78-18098

T

TABLES [DATA]
The 14818C lance missile number 3292, round number 298 APT, 24 August 1977
[AD-A048321] N78-18640
The decision table approach to reliable software
N78-18815

TAKEOFF
Concepts for estimating capacity of basic runway configurations
[PB-274578/4] N78-18036

TANTALUM
Electromigration of hydrogen and deuterium in vanadium, niobium and tantalum
N78-18177
Guidelines for the selection and application of tantalum electrolytic capacitors in highly reliable equipment
[NASA-TM-X-64755-REV-A] N78-18311

TANTALUM ALLOYS
Tantalum modified ferritic iron base alloys
[NASA-CASE-LEW-12095-1] N78-18182

TANTALUM CARBIDES
High pressure hot pressing of tantalum carbide to attain a two hundred angstrom grain size
N78-18179

TAPERING
Influence of wing tapering on the development of a three-dimensional turbulent boundary layer exemplified with a transonic wing
[BMVG-FBWT-77-7] N78-18010

TARGET ACQUISITION
Calculations of the optical properties of laser-induced plasmas in solid bodies — laser weapons target acquisition
[DLR-IB-551-77/6] N78-18943

TARGET RECOGNITION
Laser pulse speckle effects
[AD-A048598] N78-18421
Human Engineering Laboratory Identification Friend or Foe test [HELIFF]
[AD-A048784] N78-18768

TARGETS
Development of cryogenic targets for laser fusion
[LA-UR-77-1523] N78-18936

TAXONOMY
Selecting analytic approaches for decision situations Volume 1. Overview of the methodology
[AD-A047965] N78-18966
Selecting analytic approaches for decision situations Volume 2. Case studies — foreign policy and defense industries
[AD-A047880] N78-18967
Selecting analytic approaches for decision situations Volume 3. Appendices
[AD-A048228] N78-18968

TAYLOR SERIES
Approximation of a completely monotone function
[AD-A048249] N78-18842

TEARING
Theory of tearing and its application to large-scale systems
N78-18813

TECHNICAL WRITING
NUSC technical publication guidelines
[AD-A048066] N78-18978

TECHNOLOGICAL FORECASTING
The next 25 years: Industrialization of space: Rationale for planning
[NASA-TM-79360] N78-18091
Analysis of data systems requirements for global crop production forecasting in the 1985 time frame
[NASA-TP-1164] N78-18497
Post LANDSAT D Advanced Concept Evaluation [PLACE] — with emphasis on mission planning, technological forecasting, and user requirements
[NASA-CR-155769] N78-18499

TECHNOLOGY ASSESSMENT
Ion Propulsion Module [IPM] technology readiness assessment: 1985 Halley's Comet rendezvous mission
[NASA-CR-155308] N78-18120
Hybrid propulsive systems: Technology and application
[DLR-IB-456-76/11] N78-18126
Synthetic liquid fuels development: Assessment of critical factors
N78-18535
Main stages and prospects of development of space biology and medicine
N78-18680
Aviation medicine on the sixtieth anniversary of the great October revolution
N78-18681
An analysis of the technical status of high level radioactive waste and spent fuel management systems
[NASA-CR-155313] N78-18897
State-of-the-art assessment of electric vehicles and hybrid vehicles
[NASA-TM-73756] N78-18988

TECHNOLOGY TRANSFER
The role of the Department of Defense in the development of integrated circuits
[AD-A048610] N78-18332
International transfer of marine technology, a three-volume study — social, political and economic factors
[PB-275353/1] N78-18986
Information and technology transfer program for the National Science Foundation
[PB-274259/1] N78-18991

TECHNOLOGY UTILIZATION
Continued investigation of potential application of Omega navigation to civil aviation
[NASA-CR-145307] N78-18028
Fuselage structure using advanced technology metal matrix fiber reinforced composites
[NASA-CASE-LAR-11688-1] N78-18045
An RC active filter design handbook
[NASA-SP-5104] N78-18312
Heat pipes and their use in technology
[NASA-TM-75148] N78-18357
On the development of earth observation satellite systems
[NASA-TM-75064] N78-18490
Sensors Workshop summary report
[NASA-TM-74978] N78-18498
Industrial ion source technology — for ion beam etching, surface texturing, and deposition
[NASA-CR-135353] N78-18883

TEETH
Amalgam stabilization by selective interfacial amalgamation — polyacrylate dental cavity linings
N78-18178

TELEMETRY
Investigation of remote water-quality monitoring systems for use with GOES or ERTS water data transmitter
[AD-A047795] N78-18574

TELESCOPES
The mount performance of the second GEODSS telescope
[AD-A048745] N78-18912

TELEVISION CAMERAS
Common module electro optical multiplexer developer
[AD-A048484] N78-18914

TELEVISION EQUIPMENT
Test facility for television sensors applied to the detection of satellites
[AD-A048189] N78-18112
Simulation code for underwater television systems [SCOUTS]
[AD-A048769] N78-18283

TELEVISION SYSTEMS
Liquid crystal airborne display
[AD-A048198] N78-18062

TELEVISION TRANSMISSION
Concepts for the realization of TV broadcasting satellite
N78-18103

TEMPERATURE CONTROL
RF cell culture irradiation system with controlled temperature and field strength
[PB-274793/9] N78-18712

TEMPERATURE EFFECTS
A new experimental method for the accelerated characterization of composite materials
[VPI-E-78-3] N78-18132
Silicon oxidation studied by electron spectroscopy
[LYCEN-7719] N78-18167
Temperature dependence of jet swell and material functions in polymer melt systems
N78-18206
Effect of temperature and cross-linkings on the flow behavior of a rubberized epoxy resin
[UCRL-13732] N78-18220
Four-point mounting configuration for resonators subjected to severe environments
[AD-A048069] N78-18326
Deflected heated water jets, theory and experiments
N78-18354

TEMPERATURE GRADIENTS
On the question of determining the temperature shift function in the linear thermoviscoelasticity domain
N78-18211
Diffusion in a temperature gradient
N78-18346

TEMPERATURE MEASUREMENT
Sea surface temperature determination from infrared radiation. A critical evaluation of the method — coastal water circulation study
[KNMI-WR-77-5] N78-18669

TEMPERATURE MEASURING INSTRUMENTS
Design of a pyro-electric vidicon camera for medical thermography
[THT-TM-77-009] N78-18707

TENSILE STRESS
Tensile stress-strain behavior of boron/aluminum laminates
[NASA-TP-1117] N78-18135

TENSILE TESTS
Hydrogen embrittlement of niobium 3: High temperature behavior
[AD-A047957] N78-18187

TERMINAL FACILITIES
Test and evaluation of the Moving Target Detector [MTD] radar
[AD-A04788] N78-18260

TERMINAL GUIDANCE
Concepts for determination of longitudinal separation standards on final approach
[PB-274590/9] N78-18038

TERRAIN FOLLOWING AIRCRAFT
Limitations of the CH-47 helicopter in performing terrain flying with external loads
[AD-A048580] N78-18054

TEST FACILITIES
Test facility for television sensors applied to the detection of satellites
[AD-A048189] N78-18112

TEST STANDS
Two-dimensional oscillating airfoil test apparatus N78-19042
TETRODES
Reflex tetrode with unidirectional ion flow [AD-A048751] N78-18336
TEXTURES
Industrial ion source technology — for ion beam etching, surface texturing, and deposition [NASA-CR-135353] N78-18883
THEMATIC MAPPING
Selection of a seventh spectral band for the LANDSAT-D thematic mapper [E78-10078] N78-18487
THEOREM PROVING
State variable approach to the general theory of electrical machines N78-18301
Robust design for regression problems N78-18831
THEORETICAL PHYSICS
Quasi-perfect elasticity. 1: Theoretical foundations N78-18243
THERMAL ABSORPTION
Site dependent factors affecting the economic feasibility of solar powered absorption cooling [NASA-CR-150533] N78-18524
THERMAL CONDUCTIVITY
Restrictions on heat conduction in simple materials N78-18242
Thermal barrier coating system [NASA-CASE-LEW-12554-1] N78-18355
Effective thermal conductivity determination for low-density insulating materials [NASA-TP-1155] N78-18364
Forward Monte Carlo method for the solution of time-dependent heat conduction equation [AD-A048268] N78-18858
Thermal and electrical transport measurements in single crystal beryllium at low temperatures N78-18952
THERMAL CONTROL COATINGS
Thermal barrier coating system [NASA-CASE-LEW-12554-1] N78-18355
THERMAL CYCLING TESTS
Thermal cycling tests on solar cell panel samples under vacuum conditions [DLR-IB-353-77/1] N78-18563
THERMAL ENERGY
Thermal energy storage [NASA-CR-150563] N78-18520
Analysis of requirements for accelerating the development of geothermal energy resources in California [NASA-CR-155782] N78-18528
Ocean thermal energy conversion: Legal, political, and institutional aspects [PB-274123/9] N78-18568
THERMAL INSULATION
Evacuated load-bearing high performance insulation study [NASA-CR-135342] N78-18251
THERMAL RESISTANCE
Resistance strain gages for stability experiments at temperatures up to 300 deg C [NASA-TM-75246] N78-18392
THERMIONIC CONVERTERS
Boltzmann equation integration in thermionic converter conditions. Part 2: Terms in Boltzmann equation [PPPL-1346-PT-2] N78-18939
THERMOCLINES
Mixed layer observations during the NORPAX POLE experiment [AD-A048581] N78-18664
THERMODYNAMIC PROPERTIES
The thermodynamic properties of slush hydrogen and oxygen [NASA-CR-155743] N78-18168
Thermodynamic properties of U[C,N] solid solutions and derived relationships among Thermodynamic excess properties N78-18963
THERMODYNAMICS
Quasi-perfect elasticity. 1: Theoretical foundations N78-18243
Peculiarities of the initial stage of a transient in a cryogenic system N78-18250
Equations for approximating the thermodynamic data of a hydrogen/oxygen steam generator — exhaust gas temperature and characteristic velocity [DLR-IB-456-77/9] N78-18964
THERMOELASTICITY
Thermoelastic phenomena in lubricated sliding contact [AD-A047926] N78-18431
THERMOELECTRIC GENERATORS
Safety methodology for space nuclear systems [AD-A048780] N78-18898
THERMOMECHANICAL TREATMENT
The influence of thermomechanical processing on the microstructure of metastable beta-Ti alloys [AD-A048771] N78-18194
THERMOPHYSICAL PROPERTIES
National Bureau of Standards Journal of Research, section A: Physics and Chemistry, volume 81A, numbers 2 and 3, March - June 1977 [PB-275037/0] N78-18169
Thermophysical measurements on liquid metals above 4000 K [UCRL-78782] N78-18200
THERMOVISCOELASTICITY
On the question of determining the temperature shift function in the linear thermoviscoelasticity domain N78-18211
THETA PINCH
Interconnected linear theta pinches [IPPJ-316] N78-18932
THICK FILMS
Resistance ratio/temperature relationships for industrial platinum resistance thermometers of thick film construction [NPL-QU-42] N78-18407
THIN FILMS
Studies of heat transfer to gas turbine components [AD-A048551] N78-18071
Study on the formation of reaction layers on metal surfaces by using lubricant additives [DLR-FB-77-31] N78-18222
Notes on design of high efficiency beam dividers for two beam infra-red interferometers [NPL-QU-41] N78-18406
Solid phase epitaxial growth [AD-A048261] N78-18955
THIN PLATES
Full-field determination of the first derivative of normal surface displacement of thin plates using speckle photographic interferometry N78-18446
THIN WINGS
Investigation of aerodynamic characteristics of V-wings near solid surface [AD-A048555] N78-18003
THREE DIMENSIONAL BOUNDARY LAYER
Influence of wing tapering on the development of a three-dimensional turbulent boundary layer exemplified with a transonic wing [BMVG-FBWT-77-7] N78-18010
Measured Reynolds stress tensors in a three-dimensional turbulent boundary layer N78-18361
A simple finite difference technique for the computation of three-dimensional incompressible laminar boundary layers. Part 1: Description of the method [NLR-TR-76086-U] N78-18371
Phenomenological aspects of quasi-stationary controlled and uncontrolled three-dimensional flow separations N78-18380
Structure of turbulence in complex flows — shear layers N78-18385
THREE DIMENSIONAL FLOW
A computational model for three-dimensional incompressible small cross flow wall jets [AD-A048450] N78-18008
Three Dimensional and Unsteady Separation at High Reynolds Numbers [AGARD-LS-94] N78-18375
Presentation of the subject N78-18376
Phenomenological aspects of quasi-stationary controlled and uncontrolled three-dimensional flow separations N78-18380
Inviscid fluid models, based on rolled-up vortex sheets, for three-dimensional separation at high Reynolds number N78-18384
THRESHOLDS [PERCEPTION]
RF cell culture irradiation system with controlled temperature and field strength [PB-274793/9] N78-18712
THRUST
Experimental determination and comparison with theory of thrust, noise and driving weight of propeller drives — light aircraft Sportavia S5 [BMVG-FBWT-77-16] N78-18072
THUNDERSTORMS
The distribution of thunderstorm days, lightning discharges, and the incidence of lightning discharge derived from VLF sferics data [AD-A048271] N78-18634
TIDES
Non-linearly induced residual currents in tidally dominated estuaries N78-18660
Deep sea tides determination from GEOS-3 [NASA-CR-141435] N78-18661
TIME DEPENDENCE
Time dependent fault mechanics and wave propagation in rocks N78-18603
Forward Monte Carlo method for the solution of time-dependent heat conduction equation [AD-A048268] N78-18858
TIME LAG
Prediction of transionospheric signal time delays using correlative techniques [AD-A047917] N78-18268
TIME SERIES ANALYSIS
TSA: Statistical programs for interactive time series analysis [AD-A048151] N78-18848
Random coverage problems in geometrical probability with an application to time series analysis N78-18857
TIME SHARING
Verifying concurrent programs with shared data classes [AD-A048637] N78-18808
TIME SIGNALS
Synthesis of sequences for traffic signal controllers using techniques of the theory of graphs [OUEL-1189/77] N78-18993
TIROS SATELLITES
Survey: National Environmental Satellite Service [NASA-CR-150546] N78-18098
TISSUES [BIOLOGY]
Effect of surface texture by ion beam sputtering on implant biocompatibility and soft tissue attachment [NASA-CR-135311] N78-18672
RF dielectric properties measurement system: Human and animal data [PB-274776/4] N78-18711
Mucopolysaccharides and collagen of tissues in hypokinetic rats N78-18723
Effect of prolonged space flight on protein biosynthesis in various rat organs and tissues N78-18743
TITANATES
Large-aperture optical modulator materials. Lead lanthanum zirconate titanate ceramic and lithium niobate crystal show promise as modulator materials for optical transmitters with up to 6-inch apertures [AD-A048163] N78-18909
TITANIUM ALLOYS
Flight qualification of titanium F-14A airframe components manufactured by Hot Isostatic Pressing [HIP] [AD-A048485] N78-18055
National Bureau of Standards Journal of Research, section A: Physics and Chemistry, volume 81A, numbers 2 and 3, March - June 1977 [PB-275037/0] N78-18169
The influence of thermomechanical processing on the microstructure of metastable beta-Ti alloys [AD-A048771] N78-18194
Some observations on the structure of Ti-11.5Mo-6Zr-4.5Sn [beta 3] as affected by processing history [AD-A048772] N78-18195
The relationship between the microstructure and age hardening response in the metastable beta titanium alloy Ti-11.5Mo6Zr-4.5Sn [beta 3] [AD-A048773] N78-18196
Experiments on dynamic plastic loading on frames [AD-A048687] N78-18464
TITANIUM BORIDES
Titanium diboride electrodeposited coatings [AD-A047956] N78-18214
TOKAMAK FUSION REACTORS
A poloidal divertor model for Tokamak fusion reactors N78-18924
A scaling law for high density Tokamaks and its application to JIPP t-2 device [IPPJ-318] N78-18934
Survey of linear MHD stability in Tokamak configurations [COO-2456-46] N78-18942
TOLERANCES [MECHANICS]
Resistance ratio/temperature relationships for industrial platinum resistance thermometers of thick film construction [NPL-QU-42] N78-18407
Fault-tolerant software for aircraft control systems [NASA-CR-145298] N78-18797
TOPOLOGY
Interplay between algebra and topology: Groupoids in a variety N78-18866
TOROIDAL PLASMAS
Wave trajectory and electron cyclotron heating in toroidal plasmas [IPPJ-313] N78-18929
TOROIDS
Design of superconducting toroidal magnet coils and testing facility in the USA [CONF-770842-5] N78-18340
TORQUE
Torque-while-turnaround scan mirror assembly N78-19037
TOUGHNESS
Segregation effects and the toughness of high-strength steels [AD-A048448] N78-18193
TOXICITY
Toxicity of pyrolysis gases from synthetic polymers [NASA-TM-78458] N78-18127
Chemical use classification system [PB-275106/3] N78-18129

High sensitivity Fourier transform NMR. Intermolecular interactions between environmental toxic substances and biological macromolecules
[PB-274011/6] N78-18675

TRACE ELEMENTS
Trace elements in water: A development and application of sampling and sample handling procedures
N78-18571
Trace elemental characteristics of aerosols emitted from municipal incinerators
[NASA-TM-78630] N78-18572

TRAFFIC
Simulation of the 10-node data communication network operating with link speeds of 9.6 Kb/s
[NPL-COM-87] N78-18297

TRAFFIC CONTROL
Synthesis of sequences for traffic signal controllers using techniques of the theory of graphs
[OUEL-1189/77] N78-18993

TRAILING-EDGE FLAPS
Analytical study of a free-wing/free-trimmer concept — for gust alleviation and high lift
[NASA-CR-2946] N78-18000

TRAINING DEVICES
Automated weapon system trainer: Expanded adaptive module for basic instrument flight maneuvers
[AD-A048498] N78-18087
Audio-visual proficiency testing: Annotated bibliography
[AD-A048122] N78-18704

TRAJECTORY ANALYSIS
Near-surface air parcel trajectories: St. Louis, 1975
[PB-274368/0] N78-18599

TRAJECTORY OPTIMIZATION
Optimal level controls of high performance aircraft
[DLR-IB-552-77/20] N78-18059

TRANSCONTINENTAL SYSTEMS
The influence of the journey's time of day on the de-and resynchronization of the 24-hour rhythm of body and temperature after transatlantic flights
[ESA-TT-420] N78-18708

TRANSDUCERS
Solar cell angular position transducer
[NASA-CASE-LAR-11999-1] N78-18394

TRANSFER FUNCTIONS
Computer aided analysis of microwave electronic circuits in the frequency domain [ESAMEC]
[ESA-TT-441] N78-18341
Development and application of an optimization procedure for flutter suppression using the aerodynamic energy concept
[NASA-TP-1137] N78-18459

TRANSFERRING
Coupled-channel analysis for heavy-ion induced scattering and transfer reactions
N78-18894

TRANSFORMERS
Partial discharges in the transformers due to induced voltages
[NASA-TM-75256] N78-18310
Low-cost light-weight efficient 1.5 kW inverters with and without output transformers
[AD-A048449] N78-18327

TRANSFUSION
Synthesis and biological screening of novel hybrid fluorocarbon hydrocarbon compounds for use as artificial blood substitutes
[NASA-CR-155781] N78-18702

TRANSIENT HEATING
CAVE3: A general transient heat transfer computer code utilizing eigenvectors and eigenvalues
[NASA-CR-145290] N78-18359
Transient temperatures in laminated composite conical shells due to aerodynamic heating
N78-18360

TRANSIENT RESPONSE
Measurement of the impulse response of communication antennas
[AD-A048070] N78-18288
Transient, drift-dominated, bipolar conduction in dielectrics
N78-18302
Transient response of shells with internally attached structures
[AD-A048167] N78-18462

TRANSISTOR AMPLIFIERS
Amplification and discrimination of signals from proportional multiwire chambers
[ISS-T-76/6] N78-18344

TRANSITION METALS
An investigation of metal versus ligand centered redox processes in selected transition metal macrocyclic complexes. The application of a microcomputer to voltammetry
N78-18153
Transition metal-assisted oxidation of organic compounds
N78-18171
Analogies among active sites of coordinativelyunsaturated transition-metal complexes, surfaces and supported catalysts
[AD-A048289] N78-18197
The structure of complexes of mono- and polynucleotides with metal ions of the first transition group. Part 1: Crystallographic studies
[ISS-R-76/7-PT-1] N78-18891
The structure of complexes of mono- and polynucleotides with metal ions of the first transition group. Part 2: Nuclear magnetic resonance studies
[ISS-R-76/8-PT-2] N78-18892

TRANSITION PROBABILITIES
Exchange and relaxation effects in low-energy radiationless transitions
[NASA-TM-79383] N78-18882

TRANSMISSION CIRCUITS
Synthesis of linear passive time-variable transmission matrices
N78-18305

TRANSMISSION EFFICIENCY
Problems in designing a high-speed linear data bus for a multimicroprocessor system
[NPL-COM-89] N78-18817

TRANSMISSION LINES
Calculation of the per-unit length capacitance matrix for shielded insulated wires
[AD-A048174] N78-18324

TRANSMISSION LOSS
Formulation of an advanced computational capability for the prediction of transmission loss in the ocean
[AD-A048262] N78-18875

TRANSONIC FLOW
Two-dimensional transonic testing with splitter plates
[NASA-TP-1153] N78-17999
Fundamental studies of subsonic and transonic flow separation. Part 2: Second phase summary report
[AD-A048615] N78-18007
Introduction to unsteady aspects of separation in subsonic and transonic flow
N78-18381

TRANSONIC SPEED
Influence of wing tapering on the development of a three-dimensional turbulent boundary layer exemplified with a transonic wing
[BMVG-FBWT-77-7] N78-18010

TRANSONIC WIND TUNNELS
Two-dimensional transonic testing with splitter plates
[NASA-TP-1153] N78-17999

TRANSPORT AIRCRAFT
Effect of winglets on a first-generation jet transport wing. 4: Stability characteristics for a full-span model at Mach 0.30
[NASA-TP-1119] N78-17997

TRANSPORT PROPERTIES
Investigation of laser optical biasing on the quantum transport properties of n-InSb
[AD-A048229] N78-18414
Studies in application of discrete ordinates transport methods to light transport calculations: Preparation of Mie theory cross sections in Legendre polynomials
[AD-A048614] N78-18913
Inversion layer carrier distribution and carrier effective mobility in metal-oxide-semiconductor devices
N78-18948

TRANSPORT THEORY
A Monte Carlo method of solving heat conduction problems
N78-18962

TRANSPORTATION
Effects of Energy Constraints on Transportation Systems
N78-18529
Energy consumption in the transportation sector
N78-18531
Long range transportation planning under energy constraints: A critical review of current capability
N78-18532
Optimization of the vehicle-fuel-refinery system
N78-18533
Passengers in containers
[NASA-TM-75078] N78-18989

TRANSPORTATION ENERGY
ERDA funding in transportation energy conservation area and research plans
N78-18553
Data needs in transportation energy conservation research
N78-18554

TRANSPORTER
Passengers in containers
[NASA-TM-75078] N78-18989

TRANSVERSE WAVES
Nonlinear dynamic analysis of flat plate layered bodies accounting for large transverse deflections
N78-18452

TRAPPING
The role of trapping on hydrogen transport and embrittlement
N78-18175

TRAVELING WAVE MASERS
Independent gain and bandwidth control of a traveling wave maser
[NASA-CASE-NPO-13801-1] N78-18410

TRAVELING WAVE TUBES
Coupling of electromagnetic waves and space charge waves in type O traveling wave tubes
[NASA-TM-75249] N78-18309
Model 8726H traveling wave tube
[AD-A048222] N78-18316

TRINITROTOLUENE
The removal of 2, 4, 6-trinitrotoluene [TNT] from aqueous solution with surfactants
[AD-E400020] N78-18577
Charcoal regeneration. Part 1: Mechanism of TNT adsorption
[AD-A048757] N78-18578

TROPICAL METEOROLOGY
Comparison of developing versus non-developing tropical disturbance
[AD-A047780] N78-18632

TROPOSPHERE
Application of a root finding method for tropospheric ducting produced by trilinear refractivity profiles
[AD-A047916] N78-18267

TRUCKS
Energy use in intercity freight transport and policy implications
N78-18536
Energy and economic impacts of projected freight transportation improvements
N78-18537
Trucking and fuel economy
N78-18538

TUNGSTEN
Gas surface interactions — recombination reactions with tungsten and platinum
[AD-A048667] N78-18160
Computer model for vacancy-surface interactions in bcc metals
N78-18180

TURBINE BLADES
Fundamental investigations on effusion cooling of turbine blades
[DLR-FB-77-39] N78-18074

TURBINES
Theory of wind turbines with contrarotation
[UTIAS-218] N78-18556

TURBULENCE
Mean velocity, turbulence intensity and turbulence convection velocity measurements for a convergent nozzle in a free jet wind tunnel. Comprehensive data report
[NASA-CR-135238] N78-17991
Application of Doppler weather radar to turbulence measurements which affect aircraft
[AD-A048603] N78-18641

TURBULENCE EFFECTS
Presentation of the subject
N78-18376
Separation problems encountered by aircraft designers cas Div. des Etudes Avancees.
N78-18377

TURBULENT BOUNDARY LAYER
Fundamental studies of subsonic and transonic flow separation. Part 2: Second phase summary report
[AD-A048615] N78-18007
Influence of wing tapering on the development of a three-dimensional turbulent boundary layer exemplified with a transonic wing
[BMVG-FBWT-77-7] N78-18010
Turbulent boundary layers over nonstationary plane boundaries
[NASA-TM-74091] N78-18358
Measured Reynolds stress tensors in a three-dimensional turbulent boundary layer
N78-18361
Estimates of turbulent boundary layer behind a shock wave moving with uniform
[AD-A048445] N78-18369
Structure of turbulence in complex flows — shear layers
N78-18385

TURBULENT FLOW
Compressor and fan wake characteristics
[NASA-CR-155766] N78-17995
A numerical investigation of confined turbulent shear flows
N78-18356
Testing of turbulence models by exact numerical solution of the Navier-Stokes equations
[AD-A048199] N78-18365
A computer code for the simulation of turbulent swirling flow through closed-conduit flow meters
[PB-274650/1] N78-18370
Structure of turbulence in complex flows — shear layers
N78-18385
Finite element solution to equations for turbulent motion and diffusion in planetary boundary layer
N78-18605
Acoustic interference effects and the role of Helmholtz number in aerodynamic noise
[DLR-IB-257-77/11] N78-18878

TWO DIMENSIONAL BODIES
A two dimensional MHD model for magnetic field line reconnection in an incompressible and inviscid plasma
N78-18604

TWO DIMENSIONAL FLOW
Numerical solution of viscous-inviscid interaction problems in two-dimensional compressible flows based on the Navier-Stokes equations
N78-18378

Viscid-inviscid interaction methods for two-dimensional flows, including separation and shock waves
N78-18379
TWO PHASE FLOW
Study of an air lift pump in a centrifugal force field
[DLR-FB-77-40] N78-18436
TWO STAGE TURBINES
The design and evaluation of a two-phase turbine for low quality steam-water mixtures
N78-18426

U

U.S.S.R.
Aviation medicine on the sixtieth anniversary of the great October revolution
N78-18681
Space Biology and Aerospace Medicine, no. 4, 1977
[JPRS-69964] N78-18738
Pulkovo Observatory: An essay on its history and scientific activity
[NASA-TM-75083] N78-19012
U.S.S.R. SPACE PROGRAM
Main stages and prospects of development of space biology and medicine
N78-18680
Biomechanical criteria of artificial gravity
N78-18682
Change in gravitation level as a stress factor
N78-18683
Main results of medical research conducted during the flight of two crews on the Salyut-5 orbital station
N78-18684
Distinctions of fluid and electrolyte metabolism and renal function in crew members of the first Salyut-4 expedition
N78-18685
Technique for selective catheterization of the heart and great vessels used in biomedical studies of healthy individuals
N78-18686
Parameters of acid-base equilibrium and enzymatic activity of blood in man during brief antiorthostatic hypokinesia
N78-18687
Main objectives and results of the radiobiological experiment conducted on the Kosmos-690 biosatellite
N78-18688
Lactate dehydrogenase isozymes of rat skeletal muscles following a space flight and with hypokinesia
N78-18689
Morphological manifestations of functional changes in the hypothalamo-hypophyseal neurosecretory system and rat kidneys under the influence of space flight factors
N78-18690
Effect of head orientation in the gravity field on severity of caloric nystagmus
N78-18691
A study of the pulsed method of laundering
N78-18692
Significance of the percussion symptom in detection of peptic ulcers in flight personnel
N78-18693
ULCERS
Significance of the percussion symptom in detection of peptic ulcers in flight personnel
N78-18693
ULTRAHIGH FREQUENCIES
A production engineering measure for two L-band solid state microwave frequency sources
[AD-A047903] N78-18315
ULTRASONIC CLEANING
Exposure to ultrasonic noise in the Canadian forces
[AD-A048115] N78-18876
ULTRASONIC RADIATION
Preliminary experiment on acoustoelasticity for stress analysis
N78-18244
ULTRAVIOLET RADIATION
Guidelines for the simulation of the degradation of surface properties under combined UV/particle radiation
[ESA-PSS-37/QRM-06T-ISSUE-1]
N78-18444
ULTRAVIOLET SPECTRA
Activities of the Quantum Metrology Division
[NPL-QU-AR75] N78-18973
UMBILICAL CONNECTORS
The conception, birth, and growth of a missile umbilical system
N78-19044
UNDERWATER ACOUSTICS
Variability of oceanographic conditions at ocean weather stations in the north Atlantic and north Pacific Oceans
[AD-A048730] N78-18665
Frequency spreading in forward surface scattering
[AD-A048741] N78-18877
UNDERWATER PHOTOGRAPHY
Simulation code for underwater television systems [SCOUTS]
[AD-A048769] N78-18283
UNITED STATES OF AMERICA
Performance characteristics of automotive engines in the United States. Report no. 8: Mitsubishi Model 6DS7 diesel engine
[PB-274374/8] N78-18437
Performance characteristics of automotive engines in the United States. Report no. 9: Chrysler [1975] 225-CID 1-bbl engine
[PB-274375/5] N78-18438
Performance characteristics of automotive engines in the United States. Report no. 11: Chrysler [1975] 318-CID 2-bbl engine
[PB-274377/1] N78-18440
The United States energy scene 1976-1985
N78-18530
Data needs in transportation energy conservation research
N78-18554
Radiological quality of the environment in the United States, 1977
[PB-274229/4] N78-18710
UNIVAC 1108 COMPUTER
Users' instructions for the NASA/MSFC cloud-rise preprocessor program, version 6, and the NASA/MSFC multilayer diffusion program, version 6: Research version for Univac 1108 system
[NASA-CR-2945] N78-18573
FORTRAN program to determine length of gage blocks using single wavelength interferometry
[PB-274895/2] N78-18811
UNIVERSITIES
Developing an acquisitions system for a university library
[BLL-BLRDR-5351] N78-18983
UNSTEADY FLOW
Circulation control airfoil study — wind tunnel stability tests
[AD-A048677] N78-18005
Analytical solution of the generalized Helmholtz wave equation for compressible subsonic flow and calculation of the unsteady pressure distributions about oscillating spheroids
[ESA-TT-421] N78-18017
Unsteady pressure measurements on wing-store combinations in incompressible flow
[ESA-TT-426] N78-18018
Investigation of the unsteady pressure distribution on the blades of an axial flow fan
[NASA-CR-15571] N78-18068
Investigation of the jet wake discharge flow of a heavily loaded centrifugal compressor impeller
[DLR-FB-77-32] N78-18073
Three Dimensional and Unsteady Separation at High Reynolds Numbers
[AGARD-LS-94] N78-18375
Presentation of the subject
N78-18376
Introduction to unsteady aspects of separation in subsonic and transonic flow
N78-18381
Some unsteady separation problems for slender bodies
N78-18383
Prediction of unsteady separated flows on oscillating airfoils
N78-18387
UPPER ATMOSPHERE
The Nimbus 6 data catalog. Volume 9: Data orbits 6803 through 7619, 1 November - 31 December 1976
N78-18631
UPPER VOLTA
Supporting investigations during testing of the WDL-1 airship in Ghana and Upper Volta — hull temperature, flight data, operational problems
[DLR-IB-536-77/1] N78-18012
URANIUM
Thermodynamic properties of U[C,N] solid solutions and derived relationships among Thermodynamic excess properties
N78-18963
URBAN PLANNING
HUD/PTI Information Systems Improvement Program, Chief Executive's overview
[PB-274207/0] N78-18990
HUD/PTI Information Systems Improvement Program. An orientation to comprehensive information systems improvement for a local government
[PB-274177/5] N78-18994
HUD/PTI Information Systems Improvement Program: Transfer analysis methodology guide
[PB-274178/3] N78-18995
HUD/PTI Information Systems Improvement Program: Information systems analysis methodology guide
[PB-274180/9] N78-18997
Transit Planning and Operations
[PB-274535/4] N78-19004
Potential for betterment district financing and joint development applications to surface transit
[PB-274618/8] N78-19005
URBAN RESEARCH
A study of the energy consequences of alternative transport policies in intercity freight markets
N78-18547
URBAN TRANSPORTATION
The energy efficiency of urban transit systems
N78-18541
Intercity rail energy intensity for passenger movement
N78-18546
Urban applications and energy impacts of future electric cars
N78-18552
Energy intensity of various transportation modes
N78-18555
A survey on the state of research in automated scheduling of urban passenger transportation
[PB-274587/5] N78-19000
Transit Planning and Operations
[PB-274535/4] N78-19004
Potential for betterment district financing and joint development applications to surface transit
[PB-274618/8] N78-19005
USER MANUALS [COMPUTER PROGRAMS]
A users guide to the GEODSS real-time system
[AD-A048300] N78-18113
NASTRAN stress recovery package
[AD-A048744] N78-18467
The LARSYS educational package: Instructor's notes for use with the Data 100
[NASA-CR-151636] N78-18493
Users' instructions for the NASA/MSFC cloud-rise preprocessor program, version 6, and the NASA/MSFC multilayer diffusion program, version 6: Research version for Univac 1108 system
[NASA-CR-2945] N78-18573
WISP information display system user's manual
[NASA-CR-150541] N78-18623
World Wide Data Management System (WWDMS) self instruction manual, T-2 version, addendum B
[AD-A048478] N78-18784
USER REQUIREMENTS
Analysis of data systems requirements for global crop production forecasting in the 1985 time frame
[NASA-TP-1164] N78-18497
Post LANDSAT D Advanced Concept Evaluation [PLACE] — with emphasis on mission planning, technological forecasting, and user requirements
[NASA-CR-155769] N78-18499

V

VACANCIES [CRYSTAL DEFECTS]
Computer model for vacancy-surface interactions in bcc metals
N78-18180
VACUUM TESTS
Thermal cycling tests on solar cell panel samples under vacuum conditions
[DLR-IB-353-77/1] N78-18563
VANADIUM
Electromigration of hydrogen and deuterium in vanadium, niobium and tantalum
N78-18177
Electronic instability and change of crystalline phase in compounds of the V3Si type at low temperature
[NASA-TM-75178] N78-18953
VANADIUM COMPOUNDS
The effects of transition layers between CVD-vanadium dioxide films and oxide substrates
N78-18947
VAPOR DEPOSITION
High durability missile domes
[AD-A048497] N78-18101
Residual stresses in an anisotropic thick hollow cylinder of chemically vapor-deposited material due to uniform cool-down
[AD-A048301] N78-18465
VAPOR PHASES
Epitaxial growth of semi-insulating GaAs
[AD-A048466] N78-18961
VAPOR PRESSURE
The pVT properties of acetic acid
[NPL-CHEM-76] N78-18166
VAPORS
A study for hypergolic vapor sensor development
[NASA-CR-155770] N78-18224
VARIANCE
Quasi-Newton Methods
[NASA-CR-151637] N78-18871
VARIATIONS
Variability of oceanographic conditions at ocean weather stations in the north Atlantic and north Pacific Oceans
[AD-A048730] N78-18665
VASCULAR SYSTEM
Distinctive features of regional circulation and vasomotor regulation following a two-month space flight
N78-18718
VEGETATION
Application of remote sensing data to surveys of the Alaskan environment
[E78-10077] N78-18486

Selection of a seventh spectral band for the LANDSAT-D thematic mapper
[E78-10078] N78-18487

VELOCITY
A study of the effect of velocity on corrosion of galvanic couples in seawater using a circling-foil apparatus
[AD-A048065] N78-18186
The effects of velocity on corrosion of galvanic couples in seawater
[AD-A048669] N78-18191

VELOCITY MEASUREMENT
Laser velocimeter survey about a NACA 0012 wing at low angles of attack
[NASA-TM-74040] N78-18084

VENTILATION
Estimating the energy conservation potential of ventilation control through weather data analysis
[PB-273949/8] N78-18655

VENUS [PLANET]
Venus stratospheric circulation: A diagnostic study
N78-19019

VENUS ATMOSPHERE
The 16 to 40 micron spectra of Jupiter and Venus — far infrared absorption of hydrogen and sulfuric acid
N78-19008
Venus stratospheric circulation: A diagnostic study
N78-19019

VERTICAL TAKEOFF AIRCRAFT
Parametric transonic evaluation of type A VSTOL nacelle drag
[AD-A048110] N78-18002
An introduction to V/STOL technology affecting the pilot's role
[AD-A048214] N78-18765

VERY HIGH FREQUENCIES
Communication system performance model for VHF and higher frequencies
[PB-274458/9] N78-18299
Ellipticity of 0.4 to 2.4 Hertz Rayleigh waves with application to the study of near surface earth structure
N78-18600

VESTIBULAR TESTS
Cardiovascular reactions to orthostatic tests and human resistance to vestibular stimuli
N78-18724
Vestibulotonic reflexes in muscles of the rat hind limb following a flight on Kosmos-605
N78-18745

VIBRATION
Cable strumming suppression
[AD-A047996] N78-18366

VIBRATION MEASUREMENT
Concorde noise-induced building vibrations John F. Kennedy International Airport
[NASA-TM-78660] N78-18873

VIBRATION MODE
Exciter force apportioning for modal vibration testing using incomplete excitation
N78-18456

VIBRATION TESTS
Exciter force apportioning for modal vibration testing using incomplete excitation
N78-18456

VIBRATIONAL SPECTRA
Electron scattering from vibrationally excited nitrogen
N78-18881

VIDEO DATA
Video fluorometry: A novel approach to the acquisition and interpretation of multicomponent fluorescence data
N78-18142
Segmentation and structure analysis for real-time video target tracking
[AD-A048156] N78-18270

VIDICONS
Design of a pyro-electric vidicon camera for medical thermography
[THT-TM-77-009] N78-18707

VISCOPLASTICITY
Coupling of dissipative mechanisms of viscoplastic flow
N78-18238

VISCOUS FLOW
Theoretical investigation of the viscid flow around a flat plate with ground effect
[DLR-FB-77-35] N78-18016
Numerical solution of viscous-inviscid interaction problems in two-dimensional compressible flows based on the Navier-Stokes equations
N78-18378
Viscid-inviscid interaction methods for two-dimensional flows, including separation and shock waves
N78-18379

VISUAL AIDS
Audio-visual proficiency testing: Annotated bibliography
[AD-A048122] N78-18704

VISUAL PERCEPTION
Investigation of space perception by the crew of the experimental Soyuz-Apollo mission
N78-18695
Evoked cortical potentials and information processing
[AD-A048647] N78-18760
The filtering of images using a new fidelity criterion
[PB-274532/1] N78-18787

VISUAL SIGNALS
Synthesis of sequences for traffic signal controllers using techniques of the theory of graphs
[OUEL-1189/77] N78-18993

VOICE COMMUNICATION
Objective measurement of voice channel intelligibility
[AD-A048611] N78-18264

VOIGT EFFECT
Ten-place tables of the Voigt and growth functions
[AD-A047871] N78-18840

VOLTMETERS
An investigation of metal versus ligand centered redox processes in selected transition metal macrocyclic complexes. The application of a microcomputer to voltammetry
N78-18153

VORTEX SHEETS
Inviscid fluid models, based on rolled-up vortex sheets, for three-dimensional separation at high Reynolds number
N78-18384

VORTICES
Compressor and fan wake characteristics
[NASA-CR-155766] N78-17995
The formation and stability of longitudinal roll vortices in shear flows
[AD-A048691] N78-18367

W

WAKEFULNESS
Sleep wakefulness determinations from heart rate data, volume 3
[AD-A045817] N78-18703

WAKES
Compressor and fan wake characteristics
[NASA-CR-155766] N78-17995
Investigation of the jet wake discharge flow of a heavily loaded centrifugal compressor impeller
[DLR-FB-77-32] N78-18073

WALKING
Drop foot corrective device
[NASA-CASE-LAR-12259-1] N78-18762

WALL JETS
A computational model for three-dimensional incompressible small cross flow wall jets
[AD-A048450] N78-18008

WALLS
Calculations of stresses in wall ironing
[OUEL-1187/77] N78-18469

WALSH FUNCTION
WALSHSTORE: The application of burst processing to fail-soft storage systems using Walsh transforms
[AD-A047889] N78-18774

WARNING SYSTEMS
A comparison of integrated and conventional cockpit warning systems — pilot performance and reaction time in man machine systems
[AD-A048670] N78-18022
Engineering and development program plan: Wind shear
[AD-A048352] N78-18629

WASHING
A study of the pulsed method of laundering
N78-18692

WASTE DISPOSAL
An analysis of the technical status of high level radioactive waste and spent fuel management systems
[NASA-CR-155313] N78-18897
Sanitary landfills: A bibliography, volume 2
[PB-274440/7] N78-19002

WASTE WATER
The removal of 2, 4, 6-trinitrotoluene [TNT] from aqueous solution with surfactants
[AD-E400020] N78-18577

WATER
The design and evaluation of a two-phase turbine for low quality steam-water mixtures
N78-18426
Compendium of meteorology. Volume 2, part 1: General hydrology
[WMO-364] N78-18650

WATER BALANCE
Hydrological application of atmospheric vapour-flux analyses
[WMO-476] N78-18652

WATER CIRCULATION
Unconfined thermal discharges near free surfaces
N78-18351
Evaluation of circulation in partially stratified estuaries as typified by the Hudson River
N78-18476

WATER CURRENTS
Non-linearly induced residual currents in tidally dominated estuaries
N78-18660

WATER POLLUTION
Methods and standards for environmental measurement. Proceedings of the Materials Research Symposium
[PB-275008/1] N78-18128
The hazard ranking and allocation methodology: Assembly of the hazard ranking and allocation methodology: Assembly of the hazard estimation data base for air and surface water pollutants
[AD-A047826] N78-18575
Charcoal regeneration. Part 1: Mechanism of TNT adsorption
[AD-A048757] N78-18578
Environmental assessment of the Alaskan continental shelf. Northeast gulf of Alaska
[PB-275212/9] N78-18619
Digital computer control of advanced waste treatment systems
[PB-274859/8] N78-18999
Conservation districts and 208 water quality management: Non-point source identification and assessment, selection of best management practices, management agencies, regulatory programs
[PB-274411/8] N78-19001
Sanitary landfills: A bibliography, volume 2
[PB-274440/7] N78-19002

WATER QUALITY
Trace elements in water: A development and application of sampling and sample handling procedures
N78-18571
Investigation of remote water-quality monitoring systems for use with GOES or ERTS water data transmitter
[AD-A047795] N78-18574
Conservation districts and 208 water quality management: Non-point source identification and assessment, selection of best management practices, management agencies, regulatory programs
[PB-274411/8] N78-19001
Development of an unconventional approach to nitrification-dentrification
[PB-274398/7] N78-19003

WATER RECLAMATION
Wastewater characterization and process reliability for potable wastewater reclamation
[PB-274874/7] N78-18992

WATER RESOURCES
Unconfined thermal discharges near free surfaces
N78-18351
Directions in US water research: 1978 - 1982
[PB-274278/1] N78-18511

WATER TEMPERATURE
Unconfined thermal discharges near free surfaces
N78-18351

WATER TREATMENT
Investigation of magnetic water treatment devices -- calcium carbonate scale retardation
N78-18987

WATER VAPOR
Effect of drawing atmosphere on surface characteristics of glass fibers
N78-18208

WATER WAVES
The kinematics of breaking waves in the surf zone
[AD-A048723] N78-18666

WATERSHEDS
Spectral measurement of watershed coefficients in the southern Great Plains
[E78-10073] N78-18482

WAVE DIFFRACTION
The geometrical theory of diffraction - a method for the solution of electromagnetic boundary value problems of complicated structures in the high frequency case — satellite and aircraft antennas
N78-18290
The integral equation method - a computational method for diffracted and scattered fields of complicated structures — satellite and aircraft antennas
N78-18291

WAVE DISPERSION
Optical dispersion and electrical transport studies of iron intercalated zirconium diselenide
N78-18906

WAVE DRAG
A procedure for the determination of the effect of fuselage nose bluntness on the wave drag of supersonic cruise aircraft
[NASA-CR-145306] N78-17994

WAVE EQUATIONS
Analytical solution of the generalized Helmholtz wave equation for compressible subsonic flow and calculation of the unsteady pressure distributions about oscillating spheroids
[ESA-TT-421] N78-18017

WAVE FUNCTIONS
Theoretical studies of chemisorption
N78-18156

WAVE INTERACTION
Space-time evolution of nonlinear three-wave interactions
N78-18257
Coupling of electromagnetic waves and space charge waves in type O traveling wave tubes
[NASA-TM-75249] N78-18309

WAVE PROPAGATION
A theory for longitudinal wave propagation in a composite rod: A model for linear elastodynamic behavior of composite penetrators
[AD-A048552] N78-18285
Time dependent fault mechanics and wave propagation in rocks
N78-18603
A new model of nerve action potential and the existence of a pulse solution
N78-18676
Soliton and generation of cloud in nonlinear dispersive media with weak dissipation
[IPPJ-312] N78-18928
Wave trajectory and electron cyclotron heating in toroidal plasmas
[IPPJ-313] N78-18929

WAVE REFLECTION
Reflection and refraction of solitary waves: A numerical investigation
N78-18659
Reflection and absorption of ion-acoustic waves in a plasma density gradient
N78-18926

WAVEFORMS
Applications programs for the waveform processing system
[AD-A048208] N78-18824

WEAPON SYSTEMS
Automated weapon system trainer: Expanded adaptive module for basic instrument flight maneuvers
[AD-A048498] N78-18087
Joint design-to-cost guide. Life cycle as a design parameter
[AD-A048254] N78-18965

WEAR TESTS
Nondestructible MESG program
[AD-A048191] N78-18397
Wear-resistant ball bearings for space applications
N78-19038

WEATHER
An analysis of three weather-related aircraft accidents
[NASA-CR-155363] N78-18024

WEATHER FORECASTING
Forecasting daily rainfall amount for a single station using satellite photographs
[TN-21] N78-18621
Real-time computer techniques in the detection and analysis of severe storms from digital radar data
N78-18622
National Severe Storms Forecast Center
[NASA-CR-150547] N78-18625
NOAA/National Hurricane and Experimental Meteorological Laboratory
[NASA-CR-150550] N78-18627
SESAME/Environmental Research Laboratories
[NASA-CR-150551] N78-18628
Comparison of developing versus non-developing tropical disturbance
[AD-A047780] N78-18632
Tropical cyclone research by data compositing
[AD-A048168] N78-18635
Meteorological satellite observations and Army operations
[AD-A048157] N78-18636
Guide to marine meteorological services
[WMO-471] N78-18645
A snow index using 200mb warm advection
[PB-275184/0] N78-18657

WEATHER MODIFICATION
Bibliography of statistical and meteorological methodology in weather modification, II
[AD-A048686] N78-18638

WEATHER STATIONS
Variability of oceanographic conditions at ocean weather stations in the north Atlantic and north Pacific Oceans
[AD-A048730] N78-18665

WEBS [SUPPORTS]
Integrated gas turbine engine-nacelle
[NASA-CASE-LEW-12389-2] N78-18066

WEIGHTLESSNESS
Principal methods of simulating biological effects of weightlessness
N78-18739

WEIGHTLESSNESS SIMULATION
Principal methods of simulating biological effects of weightlessness
N78-18739

WELDED JOINTS
Reliability of welded joints and structures [selected articles]
[AD-A048336] N78-18442

WELDING
Reliability of welded joints and structures [selected articles]
[AD-A048336] N78-18442

WHEAT
Selection of a seventh spectral band for the LANDSAT-D thematic mapper
[E78-10078] N78-18487
A plant canopy light absorption model with application to wheat
[NASA-CR-155778] N78-18500

WIND [METEOROLOGY]
Preliminary tests of inflatable liferafts for stability in high winds
[AD-A048722] N78-18023

WIND SHEAR
The analysis of National Transportation Safety Board large fixed-wing aircraft accident/incident reports for the potential presence of low-level wind shear
[AD-A048354] N78-18021
The application of techniques for predicting STOL aircraft response to wind shear and turbulence during the landing approach
[UTIAS-215] N78-18077
WISP information display system user's manual
[NASA-CR-150541] N78-18623
Engineering and development program plan: Wind shear
[AD-A048352] N78-18629

WIND TUNNEL MODELS
PHAROS, processor for harmonic analysis of the response of oscillating surfaces — Wind tunnel models
[NLR-MP-77012-U] N78-18019

WIND TUNNEL STABILITY TESTS
Circulation control airfoil study — wind tunnel stability tests
[AD-A048677] N78-18005

WIND TUNNEL TESTS
Theoretical evaluation of high speed aerodynamics for arrow wing configurations
[NASA-TM-78659] N78-17992
Two-dimensional transonic testing with splitter plates
[NASA-TP-1153] N78-17999
Fundamental studies of subsonic and transonic flow separation. Part 2: Second phase summary report
[AD-A048615] N78-18007
Turbulent boundary layers over nonstationary plane boundaries
[NASA-TM-74091] N78-18358
Prediction of the severity of buffeting — wind tunnel tests
N78-18382

WIND TUNNEL WALLS
Design and performance evaluation of slotted walls for two-dimensional wind tunnels
[NASA-TM-78648] N78-18085

WIND TUNNELS
Mean velocity, turbulence intensity and turbulence convection velocity measurements for a convergent nozzle in a free jet wind tunnel. Comprehensive data report
[NASA-CR-135238] N78-17991
The 0.1m subsonic cryogenic tunnel at the University of Southampton
[NASA-CR-145305] N78-18086

WIND VELOCITY
Mean velocity, turbulence intensity and turbulence convection velocity measurements for a convergent nozzle in a free jet wind tunnel. Comprehensive data report
[NASA-CR-135238] N78-17991

WIND VELOCITY MEASUREMENT
Methods for indirect wind measurement — laser and acoustic appliations
[DLR-IB-553-77/5] N78-18646

WINDMILLS [WINDPOWERED MACHINES]
Theory of wind turbines with contrarotation
[UTIAS-218] N78-18556

WINDOWS [APERTURES]
Technological and experimental investigations of window frames in FRP winding press technology — glass and carbon reinforced plastics
[DLR-IB-152-77/10] N78-18254

WING OSCILLATIONS
Unsteady pressure measurements on wing-store combinations in incompressible flow
[ESA-TT-426] N78-18018
PHAROS, processor for harmonic analysis of the response of oscillating surfaces — Wind tunnel models
[NLR-MP-77012-U] N78-18019
Development and application of an optimization procedure for flutter suppression using the aerodynamic energy concept
[NASA-TP-1137] N78-18459

WINGS
Effect of winglets on a first-generation jet transport wing. 4: Stability characteristics for a full-span model at Mach 0.30
[NASA-TP-1119] N78-17997
The movement of a wing with deflected ailerons close to a screen
[AD-A048651] N78-18004
Flight tests of a radio-controlled airplane mode with a free-wing, free-canard configuration
[NASA-TM-72853] N78-18042
The effects of external stores on the flutter of a non-uniform cantilever
[AD-A048360] N78-18078
Laser velocimeter survey about a NACA 0012 wing at low angles of attack
[NASA-TM-74040] N78-18084

WIRE
Pattern prediction of wire antennas on satellite structures
[AD-A048654] N78-18279

WORKLOADS [PSYCHOPHYSIOLOGY]
Assessing pilot workload
[AGARD-AG-233] N78-18770

WORLD DATA CENTERS
World Weather Watch. International global data-processing system plan to support the first GARP global experiment
[WMO-469] N78-18651

X

X RAY ANALYSIS
Patient doses resulting from an X-ray recording (belly survey picture). Influence of technical parameters on the dosage
[IRI-190-77-01] N78-18709
NEXT - instruction manual — nationwide evaluations of X-ray trends
[ISS-T-77/1] N78-18889
The structure of complexes of mono- and polynucleotides with metal ions of the first transition group. Part 1: Crystallographic studies
[ISS-R-76/7-PT-1] N78-18891

X RAY SOURCES
Models for X-ray and radio emission from clusters of galaxies
N78-19006

X RAY SPECTROSCOPY
Initial and final state effects in Auger and X-ray photoelectron spectroscopies
N78-18144

X RAYS
Processing EMP-related flash X-ray test data with the TRANS2 computer program
[AD-A048159] N78-18276
Microchannel plate response to hard X-rays
[SAND-77-8621] N78-18403

Y

YAG LASERS
Manufacturing methods and technology engineering for neodymium doped YAG laser rods
[AD-A048662] N78-18416

YIELD STRENGTH
The effect of microstructure and strength on the fracture toughness of an 18 Ni, 300 grade maraging steel
N78-18174
The plane-strain general yielding of notched members due to combined axial force and bending. Volume 1: Wedge-shaped notches with large flank angles
[OUEL-1206/77-VOL-1] N78-18471

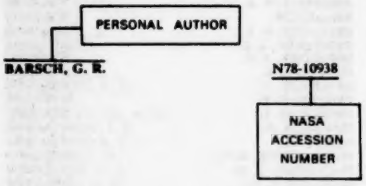
Z

ZIRCONATES
Large-aperture optical modulator materials. Lead lanthanum zirconate titanate ceramic and lithium niobate crystal show promise as modulator materials for optical transmitters with up to 6-inch apertures
[AD-A048163] N78-18909

ZIRCONIUM
Some observations on the structure of Ti-11.5Mo-6Zr-4.5Sn [beta 3] as affected by processing history
[AD-A048772] N78-18195

ZIRCONIUM COMPOUNDS
Optical dispersion and electrical transport studies of iron intercalated zirconium diselenide
N78-18906

Typical Personal Author Index Listing



Listings in this Index are arranged alphabetically by personal author. The NASA accession number denotes the number by which the citation is identified.

A

AASTROEM, K. N78-19017
ABBATE, M. N78-18212
ABBOUD, F. M. N78-18701
ABBOUND, F. M. N78-18678
ABEL, I. N78-18459
ABERCROMBIE, R. A. N78-19039
ABIDIN, B. I. N78-18735
ABOOD, K. A. N78-18476
ABOTTEEN, R. A. N78-18484
ABRAMOVA, G. M. N78-18728
ABSTON, C. C. N78-18615
ACKERMANN, H. N78-18418
ADAMOVICH, B. A. N78-18680
N78-18692
ADAMS, M. A. N78-18170
ADAMSON, A. P. N78-18066
AGNELLO, R. N78-18670
AGRAWAL, P. K. N78-18117
AHRENSDORF, K. N78-18050
AIFANTIS, E. C. N78-18248
AITKEN, J. M. N78-18328
AKATOV, Y. A. N78-18732
AKINC, M. N78-18208
ALAM, K. N78-18842
N78-18849
N78-18851
N78-18859
ALANSKY, I. B. N78-18054
ALBRECHT, J. N78-18203
ALDERS, G. J. N78-18289
ALEKSEYEV, Y. I. N78-18690
ALEM, W. K. N78-18118
ALEXANDER, S. N78-18515
ALLEN, J. H. N78-18614
N78-18615
ALLEN, R. S. N78-18607
ALLEY, P. L. N78-18623
ALMROTH, B. O. N78-18458
ALTHOF, W. N78-18468
AMODEO, F. A. N78-18036
ANCHETA, T. C., JR. N78-18773
ANDERSON, C. L. N78-18955
ANDERSON, D. J. N78-18700
ANDERSON, G. C. N78-18668
ANDERSON, J. B. N78-18278
ANDERSON, J. R. N78-18826
ANDREASSI, J. L. N78-18760
ANDREU, R. C. N78-18782
ANDREWS, A. P. N78-18030
ANTIPOV, V. V. N78-18750
ANTIPOVA, Z. P. N78-18717
ANTKOWIAK, T. A. N78-18432
AOYAGI, M. N78-18882
APANASENKO, Z. I. N78-18745
APAP, A. N78-18971
AR, C. A. N78-18316
ARCHBALD, R. N78-18319
ARLAN, L. N78-18914
ARNODO, C. N78-18343
ASHER, N. J. N78-18332
ASTLE, L. N78-18702
ASTRON, C. C. N78-18614
ATHANS, M. N78-18434
N78-18435
N78-18822
AVITZUR, B. N78-18141
AYOUB, M. M. N78-18769

B

BACHMAN, L. D. N78-18315
BAHR, A. J. N78-18443
BAILEY, M. C. N78-18263
BAKER, B. E. N78-18775
BALAKHOVSKIY, I. S. N78-18684
BALAZS, A. C. N78-18197
BALD, W. B. N78-18255
BALL, M. O. N78-18863
BALLATO, A. N78-18326
BALZER, R. N78-18802
N78-18825
BANERJEE, B. N. N78-18431
BANERJEE, D. N78-18040
BANNISTER, P. R. N78-18286
BANSAL, G. K. N78-18215
BARA, M. F. H. N78-18301
BARAN, H. A. N78-18063
BARASHENKOV, V. S. N78-18885
BARATTA, F. I. N78-18465
BARBALISCIA, F. N78-18653
BARDOS, A. M. N78-18401
BARGER, G. L. N78-18624
BARKER, J. R. N78-18586
BARKER, L. E. N78-18638
BARNATSKIY, V. N. N78-18759
BARNES, J. A. N78-18768
BARNWELL, R. W. N78-18085
BARTELT, J. L. N78-18886
BARTLETT, J. C. N78-18524
BASSFORD, R. S. N78-18260
BATENCHUK-TUSKO, T. V. N78-18719
BATESON, C. A. N78-18866
BATLIVALA, P. P. N78-18477
BATTLES, J. W. N78-18136
BAUSCH, W. N78-18482
BAXA, E. G., JR. N78-18028
BAYEVSKIY, R. M. N78-18684
BEALE, G. O., JR. N78-18082
BEAN, J. W. N78-18655
BEATTY, W. H., III N78-18665
BECKER, L. A. N78-18433
BEKEBREDE, W. R. N78-18957
BELAN, A. S. N78-18726
BELAY, V. Y. N78-18747
BELIAKOV, V. P. N78-18250
BELINSKIY, V. G. N78-18004
BELITSKAYA, R. A. N78-18755
BELKANIYA, G. S. N78-18757
BELL, J. G. N78-18676
BELLANTONI, J. N78-18026
BELLO, F. A. N78-18271
BELON, A. E. N78-18486
BELOTE, J. C. N78-18562
BENAISSA, B. N78-18221
BENNINGTON, G. N78-19000
BENSON, S. W. N78-18586
BENSON, T. P. N78-18053
BENTLEY, C. B. N78-18504
BERENZ, J. J. N78-18300
BERGER, E. N78-18059
BERKER, A. N. N78-18945
BERNARD, P. S. N78-18356
BERNECKER, R. R. N78-18225
BERNSTEIN, I. M. N78-18194
BERSTER, C. J. N78-18824
BESKOS, D. E. N78-18248
BHATIA, S. P. S. N78-18793
BHATNAGAR, N. N78-18275
BIBLARZ, O. N78-18415
BILLINGHAM, J. N78-18771
BIRNBAUM, H. K. N78-18187
BISHOP, D. F. N78-18999
BJORKLUND, J. R. N78-18573
BJORKMAN, W. S. N78-18025
BLACK, J. M. N78-18308
BLACK, P. C. N78-18903
BLACKBURN, T. F. N78-18171
BLAKE, J. B. N78-19025
BLANCHARD, B. J. N78-18482
BLANKENSHIP, C. P. N78-18182
BOARDMAN, C. N78-18271
BOCHAROV, M. N. N78-18250
BOCKER, R. P. N78-18909
BODNER, S. R. N78-18464
BOERSTOEL, J. W. N78-18009
BOESCHE, D. N78-18228
BOETO, M. N78-19038
BOGOMOLOV, V. V. N78-18741
BONDIVENNE, E. N78-19038
BOOGERS, J. A. M. N78-18475
BORMAN, G. L. N78-18163
BORODKINA, A. G. N78-18749
BORSHCHENKO, V. V. N78-18692
BORTON, D. N. N78-18561
BOSIO, C. N78-18344
BOSS, C. B. N78-18150
BOUCHER, R. F. N78-18372
BOUIS, X. N78-18374
BOUSSIOS, A. N78-18229
BOVING, H. N78-19038
BOWEN, J. N78-18984
BOWEN, J. S. N78-18584
N78-18590
BOWEN, M. W. N78-18149
BOWERS, J. E. N78-18999
BOWLES, R. L. N78-18548
BOYER, R. F. N78-18219
BRACHA, E. N78-18774
BRADSELL, R. H. N78-18406
BRADSHAW, P. N78-18385
N78-18386
BRASHER, T. F. N78-18030
BRASSER, L. J. N78-18583
BRATMAN, H. N78-18807
BREEDLOVE, J. R., JR. N78-18404
BRESLAV, I. S. N78-18725
BREWER, T. L. N78-18886
BRICE, C. W., III N78-18306
BRINE, C. N78-18670
BRINSON, H. F. N78-18132
BRISTOL, M. A. N78-18063
BRITTEN, S. S. N78-18466
BROGAN, F. A. N78-18458
BROOKS, W. F. N78-18944
BROSCHK, J. N78-18107
N78-18125
BROWN, D. M. N78-18485
BROWN, J. H., JR. N78-18000
BROWN, R. H. N78-18067
BROWN, R. V. N78-18966
N78-18967
N78-18968
BRUNNHOEFFER, G. C. N78-18446
BRYANT, R. E. N78-18783
BUEHRING, W. N78-18295
BUGAR, K. P. N78-18735
BUHL, H. N78-18204
BULDEN, M. E. N78-18430
BULISCHECK, T. S. N78-18253
BULLARD, E. N78-18897
BUMP, H. L. N78-18030
BUNN, M. M. N78-18125
BURNAZYAN, A. I. N78-18680
BURO, J. P. N78-18342
BURR, A. A. N78-18561
BURTON, R. A. N78-18431
BUSH, T. F. N78-18478
BUSHNELL, D. N78-18461
BYER, W. L. N78-18129
BYLES, W. R. N78-18062

C

CALCOTE, H. F. N78-18518
CALICCHIA, A. N78-18889
CALLEB, B. O. N78-18247
CALVERT, S. N78-18589
CAMPBELL, R. N78-18897
CAMPOSVENUTI, G. N78-18706
CAPENOS, J. M. N78-18196
CAPPELLI, J. R. N78-18557
CAPSHEW, C. E. N78-18172

CARABETTA, R. A. N78-18419
CARACENA, F. N78-18024
CARLSON, R. R. N78-18580
CASLIN, J. C. N78-18840
CASTORINA, T. C. N78-18578
CAWTHORN, J. M. N78-18873
CAZENAVE, M. N78-18492
CHACHERE, G. R. N78-18836
CHADWICK, P. N78-18242
CHALIFOUR, H. R. N78-18334
N78-18335
CHALSTROM, H. B., JR. N78-18065
CHAMBERS, F. N78-18034
N78-18039
CHAN, M. Y. N78-18621
CHANCE, J. E. N78-18500
CHANDRA, R. N78-18360
CHANG, B. J. N78-18064
CHANG, F. K. N78-18610
CHANG, J. N78-18403
CHANG, S. K. N78-18324
CHAO, K. L. N78-18017
CHAPKIS, R. L. N78-18874
CHAPMAN, C. R. N78-19016
CHAPMAN, P. K. N78-18411
CHARLES, J. P. N78-18087
CHASE, W. D. N78-18083
CHATTLE, M. V. N78-18407
CHATTOORGOON, V. N78-18896
CHATURUEDI, P. K. N78-18612
CHEBOTAREV, A. I. N78-18650
CHEBOTAREV, S. N78-18810
CHEKIRDA, I. F. N78-18740
CHEMARIN, M. N78-18342
CHEN, B. H. N78-18173
CHEN, C. H. N78-18007
CHEN, G. H. N78-18900
CHEN, I. N78-18941
CHEN, M. H. N78-18882
CHEN, W. H. N78-18447
CHESTUKHIN, V. V. N78-18686
N78-18687
CHEVALIER, M. N78-18342
CHINN, M. D. N78-18946
CHOCKIE, A. N78-18897
CHOU, E. J. N78-18577
CHOUDHURY, A. N78-18917
N78-18918
N78-18919
CHU, T. K. N78-18938
CLAPP, D. F. N78-18026
CLARK, D. L. N78-18844
CLASPY, P. C. N78-18417
CLAYTON, J. D. N78-18193
CLEVERDON, C. W. N78-18979
COEURE, P. N78-18405
COFFEY, H. E. N78-19023
N78-19024
COGGIOLA, M. J. N78-18888
COLBURN, W. S. N78-18064
COLEMAN, M. G. N78-18516
COLLINS, F. G. N78-18007
COLMAN, R. W. N78-18789
COLOMBANT, D. G. N78-18887
COMFORT, W. J., III N78-18426
COMPTON, B. M. N78-18284
CONDE, E. N78-19038
CONSTANTIN, S. D. N78-18772
CONSTANZ, J. C. N78-18549
CONWAY, A. J. N78-18982
COOK, B. J. N78-18657
COOK, N. H. N78-18434
N78-18435
COONAN, J. R. N78-18026
COOPER, W. D. N78-18904
COOPERSTEIN, G. N78-18887
COORS, D. N78-18015
COPELAND, R. L. N78-18895
CORDELLI, M. N78-18344
COSBY, P. C. N78-18611
COURTIER, J. D. N78-18030
COUSINS, M. D. N78-18282
COY, J. J. N78-18429
CRABTREE, R. B. N78-18876
CRANDALL, D. H. N78-18937
CRASEMANN, B. N78-18882
CRAWFORD, M. L. N78-18898
CROFT, W. J. N78-18214
CROWELL, P. G. N78-18161
CUMMINGS, J. R. N78-18186
CUNNINGTON, G. R. N78-18251
CURRY, D. M. N78-18364
CYGNAROWICZ, T. A. N78-18673
CZIKA, J. N78-18875
CZUCHRY, A. J. N78-18063

D

DADAEV, A. N. N78-19012
DANDAGE, S. R. N78-19027
DANIEL, B. E. N78-18596
DANIEL, I. M. N78-18140
DANIELS, M. R., JR. N78-18023
DANNEVIK, W. P. N78-18599
DAUBEK, T. P. N78-18703
DAVAL, J. N78-18405
DAVEY, W. B. N78-19001
DAVIS, J. M. N78-18054
DAVIS, R. W. N78-18370
DAVIS, S. N78-17999
DAVYDOV, B. I. N78-18750
DEBOAR, E. N78-18371
DEBOO, G. J. N78-18312
DEBRA, D. B. N78-18609
DEGRAAF, E. A. B. N78-18475
DEGTYAREV, V. A. N78-18684
N78-18719
DEHUFF, G. L. N78-18205
DEIS, B. C. N78-18762
DEIVANAYAGAM, S. N78-18769
DEJONGE, J. B. N78-18047
N78-18052
DEJOSSELINDEJONG, G. N78-18236
DELAMARCHE, A. N78-18260
DELOACH, R. N78-18873
DEMAREE, R. G. N78-18985
DEMENT, J. M. N78-18591
DEMEO, R. C. N78-18914
DEMPSEY, D. J. N78-18265
DENNIS, T. B., JR. N78-19045
DENTZ, D. N78-18416
DEROECK, D. J. N78-18582
DESANTIS, C. M. N78-18273
N78-18274
DEVINE, E. J. N78-19045
DEVOE, D. N78-18026
DEWIT, R. N78-18241
DIACONIS, P. N78-18853
DIETERLY, D. L. N78-18063
DIETZ, J. F. W. N78-18276
DIMAGGIO, F. L. N78-18462
N78-18463
DIMARIA, D. J. N78-18328
DISTEFANO, T. N78-18328
DITTBERNER, G. J. N78-18620
DIVITA, E. N78-18897
DOBBINS, D. A. N78-18764
DOBROTT, R. D. N78-18338
DODD, B. N78-18469
N78-18470
N78-18471
N78-18473
N78-18658
DODGE, R. A. N78-18845
DOLAN, K. N78-18403
DOLAN, K. W. N78-18488
DOLAN, R. N78-17992
DOLLYHIGH, S. M. N78-18737
DOMASHUK, Y. N78-18607
DONATELLI, D. E. N78-18670
DONNELLEY, L. N78-18800
DONNELLY, T. M. N78-18596
DONOVAN, R. P. N78-18685
DOROKHOVA, B. R. N78-18719
DOROSHEV, V. G. N78-18587
DORSET, P. N78-18897
DOUTHITT, C. N78-18159
DOWLING, R., II N78-18497
DOWNS, S. W. N78-18069
DOYLE, V. L. N78-18269
DRAGAVON, E. J. N78-18729
DRUGOVA, N. A. N78-18688
DRUZHININ, Y. P. N78-18286
DUBE, R. L. N78-18215
DUCKWORTH, W. H. N78-18722
DUDETSKIY, V. I. N78-18987
DUFFY, E. A. N78-18071
DUNN, M. G. N78-18530
DUPREE, W. G., JR. N78-18531
N78-18412
DYSON, F. J.

E

EAVES, B. C. N78-18852
ECKARDT, D. N78-18073
ECKBERG, D. L. N78-18678
EDELSON, E. N78-18897
EDWARDS, R. C. N78-18663
EFIMOVA, V. N. N78-18211
EGGUM, G. E. N78-18430
EIMER, C. N78-18245
EISENHARD, R. M. N78-18567
ELAM, J. N78-18805
ELBASSIOUNI, M. Y. N78-18829
ELROD, H. G. N78-18217
ELVEY, L. N78-18029
ENGEL, H. E. N78-18063
ENGLISH, T. N78-18897
ERDOES, E. N78-18201
ERDOS, P. N78-18853
ERICKSON, S. L. N78-18632
ERNSTOFF, M. N. N78-18062
ESIMAI, G. O. N78-18830
ETHRIDGE, E. C. N78-18207
EVANS, A. G. N78-18430
EVANS, F. A. N78-18104
EVDOKIMOV, O. B. N78-18927
EVERS, L. N78-18163
EZEKWE, C. I. N78-18361

F

FAIR, B. C. N78-18282
FAIRCHILD, R. W. N78-18504
FALVEY, H. T. N78-18658
FEDI, F. N78-18653
N78-18654
FEDORENKO, B. S. N78-18751
FEDOROV, Y. A. N78-18693
FELDER, W. N78-18518
FELDMAN, K. L. N78-18710
FERRANTE, J. G. N78-18341
FERZIGER, J. H. N78-18365
FETTIS, H. E. N78-18840
FIDLER, E. J. N78-18970
FIMPEL, H. P. N78-18408
FINFER, M. C. N78-18807
FISHER, B. D. N78-18044
FITZ, A. E. N78-18701
FITZPATRICK, G. L. N78-18663
FLANAGAN, T. M. N78-18317
FLATLEY, T. W. N78-19039
FLEMMING, D. K. N78-18565
FLESKES, W. N78-18293
FLYNN, G. T. N78-18099
FORD, A. W. N78-18574
FORDE, J. L. N78-18870
FORSHAW, S. E. N78-18876
FOSTER, T. N78-18067
FOWLER, J. B. N78-18785
FRALEY, S. K. N78-18962
FRANCIS, G. P. N78-18281
FRANK, W. M. N78-18635
FRANKE, G. F. N78-18068
FRANKLIN, A. G. N78-18610
FREDRICKSON, C. D. N78-18528
FREEMAN, J. E. N78-18975
FREEMAN, W. B., JR. N78-18634
FREMOUW, E. J. N78-18282
FRENCH, A. N78-18539
FREYMANN, R. N78-18014
FRIEDEL, J. N78-18953
FRISELLA, S. N78-18599
FRITTS, M. J. N78-18368
FROES, F. H. N78-18194
N78-18195
N78-18196
FRULLANI, S. N78-18706
FUCHS, H. V. N78-18878
FUGAS, M. N78-18585
FULJKSCHOT, P. H. N78-18019
FUJITA, T. T. N78-18024
N78-18636
FUKUNAGA, K. N78-18270
FUKUOKA, H. N78-18244
FULLER, E. O. N78-18330
FUNK, K. W. N78-18100
FUNSTON, W. H. N78-18092

G

GAARENSTROOM, P. D. N78-18569
GAARENSTROOM, S. W. N78-18144
GAEDKE, M. N78-18254
GAHR, S. N78-18187
GALLICHIO, J. A. N78-18760
GAMAUF, K. J. N78-18264
GANNAWAY, J. N. N78-18917
N78-18918
N78-18919
GARDNER, R. N. N78-18181
GARNETT, T. S., JR. N78-18054
GARRETT, R. F. N78-18837
GATES, C. L. N78-18867
GATHERS, G. R. N78-18200
GAYDAKIN, N. A. N78-18747
GAZENKO, O. G. N78-18679
N78-18680
N78-18684
N78-18686
N78-18717
GEE, S. W. N78-18042
GEIGER, T. N78-18201
GELFAND, A. E. N78-18972
GELLER, W. N78-18016
GENTILMAN, R. N78-18101
GENTRY, G. L., JR. N78-18358
GERASIMOVA, G. K. N78-18727
GERBERICH, W. W. N78-18248
GERSHWIN, S. B. N78-18434
N78-18435
GERSTNER, D. A. N78-18497
GEYKHMAN, K. L. N78-18730
GHOLAMNEZHAD, A. H. N78-18517
GIBBONS, D. F. N78-18672
GIBSON, F. L. N78-19042
GIBSON, K. J. N78-18030
GILBERT, A. L. N78-18270
GILES, M. K. N78-18270
GILLHAM, J. K. N78-18219
GIMMESTAD, G. G. N78-18277

GINSBURG, Y. V. N78-18728
GLASIER, J. M. N78-18063
GLOD, G. D. N78-18716
N78-18747
GLOVER, F. N78-18804
N78-18814
GNOFFO, P. A. N78-18362
N78-18363
GODFREY, S. E. N78-19027
GOLDEN, D. M. N78-18586
GOLDEN, J. N78-18336
GOLDFLAM, R. N78-18880
GOLDMAN, N. N78-18802
N78-18825
GOLDSTEIN, S. A. N78-18887
GOLIGHTLY, G. O. N78-18868
GOLTZ, G. N78-18558
GOMEZ-TAYLOR, M. M. N78-18151
GONCHAROV, I. R. N78-18741
GONCHAROVA, L. A. N78-18743
GOODCHILD, W. N78-18260
GOODHART, C. L. N78-18267
GOODMAN, A. M. N78-18345
GOODMAN, P. S. N78-18969
GOODYER, M. J. N78-18086
GORBACHEV, S. P. N78-18250
GORBUNDOVA, A. V. N78-18744
GORDON, A. N78-18283
GORDON, L. E. N78-18668
GORKINA, Z. G. N78-18392
GORYACHEVA, L. L. N78-18722
GORYAYEV, B. I. N78-18759
GOVIL, A. K. N78-18230
GOYOT, M. N78-18342
GOZULOV, S. A. N78-18684
GRAF, W. O. N78-18077
GRAHAM, C. D., JR. N78-18517
GRAHAM, K. J. N78-18186
GRANT, E. R. N78-18888
GRASBERGER, W. H. N78-18940
GRAY, D. L. N78-18394
GRAY, W. M. N78-18635
GREED, J. J., JR. N78-18399
GREENE, F. M. N78-18714
GREENSPAN, D. C. N78-18130
GREGERSEN, A. W. N78-18893
GREGOREK, G. M. N78-18000
GREGORIOU, G. N78-18013
GRENON, L. A. N78-18516
GRESHAM, L. L. N78-18820
GRIERSON, R. N78-18198
GRIGORYAN, A. S. N78-18717
GRIGORYEV, A. I. N78-18685
GRIGORYEV, Y. G. N78-18688
GRILLY, E. R. N78-18936
GRODZKA, P. G. N78-18520
GROOM, N. J. N78-18252
GRUEN, E. N78-18899
GUELMAN, M. N78-18031
GUICHERIT, R. N78-18583
GULDE, F. J. N78-18030
GUPTA, S. S. N78-18860
GUROVSKIY, N. N. N78-18680
GUSEYNOV, F. T. N78-18742
GUY, A. W. N78-18712

H

HA, T. T. N78-18305
HABBAL, S. R. N78-18604
HABERMAN, J. N78-18578
HADGIGEORGE, G. N78-18798
HAFEN, B. E. N78-18366
HAH, C. N78-17995
HAINES, A. L. N78-18036
N78-18038
HALE, P. G. N78-18917
N78-18918
N78-18919
HALL, C. A. N78-18020
HALL, D. W. N78-18000
HALL, F. R. N78-18030
HALL, R. E. N78-18584
N78-18590
HALL, W. M. N78-18105
HAMADA, Y. N78-18929
HAMILTON, M. R. N78-18562
HAMILTON, W. N78-18551
N78-18552
HANNI, W. N78-19038
HANSON, M. A. N78-18638
HARDING, D. S. N78-19010
HARDWICK, W. N78-18317
HARGRAVE, C. W. N78-18975
HARRIS, G. M. N78-18216
HARRISON, E. N78-18320
HARRISON, S. H. N78-18571
HARTGEN, D. T. N78-18532
HARTMAN, W. J. N78-18264
HARTMANN, G. K. N78-18607
HARVEY, S. N78-18702
HAUBENREICH, P. N. N78-18340
HAUGER, J. S. N78-18562
HAYDEN, B. N78-18488
HEAD, J. W. N78-19022
HEAP, A. R. N78-18812
HEBENSTREIT, G. T. N78-18659
HENDERSON, R. E. N78-18068
HENDRY, E. M. N78-19011
HENRIKSEN, S. W. N78-18617
HEPNER, T. E. N78-18084
HERINGTON, E. F. G. N78-18165
HERMAN, N. A. N78-19027
HERRMANN, H. N78-18296
HERSHBERGER, M. L. N78-18269
HEYWOOD, J. N78-18488
HILADO, C. J. N78-18127
HILBERT, E. E. N78-18495
HILTON, H. H. N78-19025
HINDLE, A. N78-18983
HINTERMANN, H. E. N78-19038
HOAD, D. R. N78-18084
HOBBS, V. J. N78-18026
HOCKER, A. J., JR. N78-19042
HODGDON, R. B. N78-18515
HODGES, D. H. N78-18043
HODGSON, W. M. N78-18200
HODKINSON, P. H. N78-18472
HOEFLE, R. N78-18319
HOEKSMA, G. S. N78-18707
HOEY, W. F. N78-19004
HOGGER, E. I. N78-18815
HOLLADAY, A. M. N78-18311
HOLLIDAY, B. G. N78-18873
HOLLINGER, G. N78-18167
HOLMAN, G. D. N78-19006
HOLMES, B. J. N78-18044
HOLMES, D. W. N78-18030
HOLMES, H. K. N78-18873
HOLMES, P. T. N78-18847
HOLMES, Q. A. N78-18487
HOLPP, J. E. N78-18048
HOLT, A. W. N78-18977
HOLTZSCHEITER, E. W. N78-18898
HOOK, H. O. N78-18345
HOPKINS, J. B. N78-18545
HOPPMANN, W. H., II N78-18865
HOREV, Y. N78-18435
HORNICK, C. W. N78-18985
HORWOOD, E. M. N78-19005
HOSSAIN, A. N78-18489
HOUSLEY, R. M. N78-19021
HOWLAND, B. N78-18911
HRIBSEK, M. F. N78-18304
HRUBY, R. J. N78-18025
HSING, C. T. N78-18948
HSU, J. N78-18941
HSU, L. C. N78-18448
HSU, T. S. T. N78-18923
HUANG, K. N. N78-18884
HUANG, K. T. N78-18323
HUGGETT, C. N78-18158
HUGGINS, R. A. N78-18559
HULL, L. J. N78-18599
HULTZ, J. N78-18804
N78-18814
HUMEL, P. F. N78-18111
HUNER, B. N78-18347
HUNT, B. R. N78-18404
HUNTER, C. H. N78-18638
HUNTER, W. R. N78-18328
HUYGEN, C. N78-18583

I

ICHIKAWA, Y. H. N78-18931
ILIFF, K. W. N78-18075
ILIFFE, J. K. N78-18799
ILIN, Y. A. N78-18688
ILLE, B. N78-18342
INGHAM, M. N78-18163
INOUE, S. N78-18934
ISHIHARA, O. N78-18926
ISHMUKHAMETOVA, D. N. N78-18728
ISRAEL, J. N78-18562
ITOH, K. N78-18934
IVANOV, A. A. N78-18731
IVANOVA, L. T. N78-18392
IYER, R. R. N78-18037

J

JACKSON, M. R. N78-18183
JAIN, A. N78-18266
JAMES, G. E. N78-19035
JAMES, L. R. N78-18985
JAMES, L. W. N78-18557
JAMIESON, I. M. N78-18602
JEA, Y. H. N78-18792
JEFFERS, E. N78-18674
JENNINGS, R. D. N78-18299
JENSEN, C. L. N78-18177
JENSEN, P. N78-18670
JENSEN, R. V. N78-18940
JEPPESEN, P. N78-18916
JEUN, B. H. N78-18624
JIN, K. K. N78-18030
JOHANSON, J. M. N78-18608
JOHNSON, D. E. N78-18137
JOHNSON, G. L. N78-18766
JOHNSON, K. H. N78-18197
JOHNSON, L. C. N78-18938
JOHNSON, M. C., JR. N78-18206
JOHNSON, P. B. N78-18671
JOHNSON, R. M. N78-18087
JOHNSON, W. B. N78-18618
JOHNSON, W. E. N78-18093
JOLLY, S. T. N78-18961
JONES, T. S. N78-18205
JOUAN, J. N78-19028
JOUVE, H. N78-18405
JUDAY, R. D. N78-18484
JUNEAU, G. P. N78-18145

K

KABACHENKO, A. N. N78-18751
KAISER, L. M. N78-18558
KAKURIN, L. I. N78-18686
KALINICHENKO, V. V. N78-18720
KAMENTSEVA, L. N. N78-18392
KANDA, M. N78-18339
KANELLAKIS, P. C. N78-18434
N78-18435
KAO, M. H. N78-18813
KAPETANAKOS, C. A. N78-18336
KARR, A. F. N78-18861
KATKOV, V. Y. N78-18686
N78-18687
KATON, J. E. N78-18162
KAUFMAN, H. R. N78-18883
KAUL, S. K. N78-18354
KAURICHEVA, N. I. N78-18687
KAW, P. N78-18941
KAZARYAN, V. A. N78-18743
KEE, R. J. N78-18079
KELLEHER, D. N78-18898
KELLNER, J. D. N78-18214
KELLY, D. L. N78-18485
KELLY, R. E. N78-18367
KEMMERER, R. B. N78-18146
KENNEDY, K. W. N78-18769
KENNEDY, R. S. N78-18280
KENNING, D. B. R. N78-18373
KERN, G. N78-18029
KESTIGIAN, M. N78-18957
KETCHAM, S. J. N78-18188
KHARADI, H. N78-18223
KHMELKOV, V. P. N78-18746
KHOKHLOVA, O. S. N78-18748
KHOSLA, P. K. N78-17996
KHUDYAKOVA, M. A. N78-18733
KIESSLING, F. N78-18474
KILDOW, J. N78-18986
KIM, B. T. N78-18894
KING, R. J. N78-18921
KINNEY, J. M. N78-18832
KIRCHHOFF, W. H. N78-18128
KIRILLOVA, Z. A. N78-18719
KIRK, R. N78-18670
KLAHS, J. W., JR. N78-18457
KLEIN, J. J. N78-18914
KLEINSTEIN, B. H. N78-18705
KLINE, P. J. N78-18826
KLINGMAN, D. N78-18804
N78-18805
N78-18814
KLOBUCHAR, J. A. N78-18608
KLOKOVA, N. P. N78-18392
KNAAK, S. N78-18899
KNAPP, R. W. N78-18600
KNIGHT, F. W. N78-19030
KNIGHT, H. G. N78-18568
KNOTT, J. F. N78-18193
KNUST, H. E. N78-18278
KOEHN, D. N78-18103
KOEPP, F. N78-18296
N78-18646
KOERNER, H. N78-18058
KOGAN, R. A. N78-18784
KOLARI, H. J. N78-18197
KOLESNIK, A. G. N78-18717
KOLESOV, M. A. N78-18756
KOMISSAROVA, N. A. N78-18717
KOMOLOVA, G. S. N78-18742
KOMPFNER, R. N78-18917
N78-18918
N78-18919
KONKOVA, O. V. N78-18721
KOPER, J. N78-18544
KORNILOVA, L. N. N78-18695
KOSOLA, K. L. N78-18127
KOSSECKA, E. N78-18241
KOSSYK, R. N78-18899
KOSTKOWSKI, H. J. N78-18256
KOTENKO, V. A. N78-18759
KOTTENSTETTE, J. P. N78-18975
KOURTIDES, D. A. N78-18127
KOVALENKO, Y. A. N78-18739
KOVALEV, Y. Y. N78-18680
N78-18732

KOZYREVSKAYA, G. I. N78-18685
KRAAN, C. N78-18669
KRABILL, W. B. N78-18265
KRAFT, D. N78-18059
KRAMER, F. E. N78-19020
KRAMER, G. M. N78-18960
KRAUSE, P. F. N78-18162
KRONWITH, S. D. N78-18828
KROPFLI, R. A. N78-18656
KRUGER, R. P. N78-18404
KRUPINA, T. N. N78-18746
KRUSE, H. N78-18074
KRUTKO, V. N. N78-18691
KRYLOV, Y. V. N78-18696
KUCZER, P. N78-18345
KUEHN, K. D. N78-18136
KUESTERS, E. N78-18320
KUHN, J. N78-18026
KUHN, P. N78-18204
KUKSOVA, M. I. N78-18757
KULASH, D. J. N78-18542
KULLSTAM, P. A. N78-18258
KURBANOV, V. V. N78-18746
KUSTOV, V. V. N78-18735
KUSUDA, T. N78-18655
KUZMIN, M. P. N78-18746
KUZNETSOV, A. G. N78-18746
N78-18759

L

LABBE, J. N78-18953
LACARNA, R. J. N78-18819
LAI, D. M. N78-18445
LAKSHMINARAYANA, B. N78-17995
LALL, C. N78-18517
LAM, P. M. N78-18348
LAMBERSON, S. E. N78-18467
LAMBERT, M. N78-18342
LAMEIRO, G. F. N78-18514
LAN, C. E. N78-17993
LANDON, S. N. N78-18113
N78-18912
LANDSTRASS, M. N78-18138
LANDY, M. A. N78-18048
LANE, C. R. N78-18907
LANGAN, J. D. N78-18954
LANGE, H. N78-18249
LANGE, T. N78-18109
LANNIELLO, J. P. N78-18660
LAPOINTE, C. W. N78-18543
LAPSHINA, N. A. N78-18719
LAPTEV, Y. I. N78-18004
LARRABEE, G. B. N78-18338
LARSEN, N. T. N78-18402
LARSEN, P. A. N78-18497
LARSON, R. S. N78-17991
LASKA, R. N78-18587
LATYPOV, F. F. N78-18003
LAU, J. H. S. N78-18449
LAWRENSON, I. J. N78-18166
LAWSON, D. N78-18702
LEADER, J. C. N78-18421
LEBALLEUR, J. C. N78-18379
LEBEDEV, V. I. N78-18685
LEE, D. A. N78-18166
LEE, H. N. N78-18605
LEE, J. T. N78-18641
LEE, R. N78-18887
LEE, W. H. N78-18822
LEE, Y. T. N78-18888
LEES, B. N78-18216
LEES, L. N78-18897
LEHNERT, W. G. N78-18790
LEIBERT, C. H. N78-18355
LEILICH, R. H. N78-18537
LEITINGER, R. N78-18607
LEMASTER, E. W. N78-18500
LEMCOE, M. M. N78-18393
LEONARD, T. J. N78-18613
LESK, I. A. N78-18516
LESTER, M. S. N78-19005
LEVEQUE, G. N78-18114
LEVY, G. C. N78-18675
LEWELLEN, W. S. N78-18633
LEWIS, G. B. N78-18166
LEWIS, R. B. N78-18873
LEY, W. N78-18563
LICKLEDERER, A. N78-18012
LIEBE, H. J. N78-18277
LIMAYE, S. S. N78-19019
LIN, W. N. N78-18606
LIND, M. A. N78-18785
LINDEN, L. H. N78-18534
LINDEN, T. N78-18916
LINDENLAUB, J. C. N78-18493
LINDHOUT, J. P. F. N78-18371
LINDINGER, H. N78-18222
LINDMAYER, J. N78-18519
LINDSTROM, D. N78-18913
LINEVSKY, M. J. N78-18419
LING, R. F. N78-18801
N78-18803
LING, S. N78-18220
LINK, L. E., JR. N78-18503
LIONG, S. Y. N78-18479
LIPELES, R. N78-18319
LIPS, H. R. N78-18122
N78-18124
N78-18126
LIPTON, R. J. N78-18872
LIU, T. K. N78-18324
LIVINGSTON, R. C. N78-18282
LOCKE, J. S. N78-18186
N78-18190
N78-18554
LOEBL, A. N78-18974
LOHMAN, G. M. N78-18940
LOKKE, W. A. N78-18753
LOKSHINA, Y. N. N78-18800
LONG, R. L., JR. N78-18349
LOPEZ, J. L. N78-18100
LORAINE, R. N78-18201
LORENZ, M. N78-18838
LOSER, R. E. N78-18202
LOVEDAY, M. S. N78-18557
LOWE, L. F. N78-18694
LOZINSKIY, V. S. N78-18450
LUCHINI, J. R. N78-18671
LUDWICK, J. C. N78-18618
LUDWIG, F. L. N78-18203
LUETJERING, G. N78-18846
LUKES, J. W. N78-18753
LUKYANOVA, N. F. N78-18340
LUTON, J. N. N78-18722
LUTSENKO, N. M. N78-18839
LUTZ, J. A. N78-18747
LYSAK, V. E.

M

MABEY, D. G. N78-18382
MACAIONE, D. P. N78-18159
MACKAY, K. P. N78-18588
MADDOCK, L. N78-18026
MADNICK, S. E. N78-18782
MAEKAWA, T. N78-18929
MAEWAL, A. N78-18285
MAGUIRE, E. N78-18101
MAHAFFEY, R. A. N78-18336
MAIANI, L. N78-18706
MAINE, R. E. N78-18075
MAKENAS, B. J. N78-18185
MAKEYEVA, V. F. N78-18742
MAKSIMOV, R. D. N78-18211
MALCHIKOV, V. V. N78-18758
MALMUTH, N. D. N78-18008
MALOTA, F. N78-18943
MANESS, S. G. N78-18023
MANKA, M. J. N78-18158
MANLY, P. L. N78-18095
N78-18112
MANNELLA, G. N78-18553
MANSKI, D. N78-18108
N78-18109
N78-18123
N78-18125
N78-18436
N78-18959
N78-18081
MANTE, J. N78-18833
MARADUDIN, A. A. N78-18678
MARCHAND, M. N78-18701
MARCHEGIANI, B. V. N78-18882
MARK, A. L. N78-18748
N78-18023
MARK, H. N78-18077
MARKARYAN, M. V. N78-18441
MARKLE, R. L. N78-18864
MARKOV, A. B. N78-18874
MARKOWITZ, O. N78-18601
MAROUF, A. R. N78-18437
MARSH, A. H. N78-18438
MARSHALL, E. W. N78-18439
MARSHALL, W. F. N78-18440
N78-18959
N78-18960
MARTIN, B. G. N78-18331
N78-18342
MARTIN, C. T. N78-19042
MARTIN, J. P. N78-18069
MATSUHIRO, D. S. N78-18405
MATTA, R. K. N78-18661
MAUDUIT, D. N78-18603
MAUL, G. A. N78-18051
MAVKO, G. M. N78-18483
MAXWELL, R. D. J. N78-18873
MAY, G. A. N78-18221
MAYES, W. H. N78-18758
MAYOUX, C. N78-18022
MAZIN, A. N. N78-18361
MAZZA, J. D. N78-18323
MCALLISTER, J. E. N78-17991
MCCLAINE, A. W. N78-18388
MCCOLGAN, C. J. N78-18381
MCCORMACK, R. W. N78-18383
MCCROSKEY, W. J. N78-18387
N78-18153
MCELROY, F. C. N78-18869
MCGIBBON, C. A.
MCHUGH, D. P.
MCINTURFF, R. M.
MCMAHAN, P. C.
MCMAHON, J. H.
MCMILLAN, J.
MCMILLAN, O. J.
MEANA, G. M.
MEEKER, M. D.
MEGGITT, D. J.
MEHROTRA, S. C.
MEIER, H.
MELNIKOVA, Y. P.
MENDENHALL, G. D.
MENSE, A. T.
MERLO, U.
MERRILL, O. H.
MESIATS, G. A.
METCALFE, G. N.
METTAUER, J. C.
MEYER, R. R., JR.
MEYERS, J. F.
MICHEJDA, J. A.
MIDZUNO, Y.
MIKHAYLOV, V. M.
MIKKELSON, R. L.
MILLER, B. A.
MILLER, C.
MILLER, J. A.
MILLER, J. M.
MILLER, K. A.
MILLER, L. E.
MILLION, D. J.
MILLS, M. T.
MILNER, B. R.
MIRELS, H.
MITCHELL, G. W.
MITCHELL, M. A.
MITCHELL, O. R.
MITTAL, R. K.
MOACANIN, J.
MODY, K. J.
MOELLER, K. D.
MOGENDOVICH, M. R.
MOGILNAYA, G. M.
MONAHAN, M. A.
MONTENEGRO, A.
MONTGOMERY, J. P.
MOOIJ, H. A.
MOON, R. L.
MOORADIAN, G. C.
MOORE, E. F.
MOORE, G. S.
MOREL, P.
MORENKOVA, S. A.
MORGAN, P. H.
MORISSET, J.
MORLOK, E. K.
MOROSOW, G.
MORRIS, C. G.
MORRIS, D. H.
MORRIS, L. D.
MORRISON, A.
MORRISON, J. F.
MORRISON, P.
MORRISON, S. R.
MORUKOV, B. V.
MOSELEY, J. T.
MOSHER, D.
MOULDEN, T. H.
MUKHERJEE, A. K.
MUKHINA, N. N.
MULVEY, J.
MYASNIKOV, V. I.
MYERS, D.
MYERS, P. S.

N

NADKARNI, A. A. N78-18428
NAEHLE, R. N78-18109
NAERLOVIC-VELJKOVIC, N. N78-18239
NAGY, F., JR. N78-18027
NAKHILNITSKAYA, Z. N. N78-18727
N78-18749
NAMBA, C. N78-18935
NAP, J. L. N78-18648
NEALE, P. T. N78-18817
NEFEDOV, Y. G. N78-18680
NELSON, A. C. N78-18566
NELSON, R. H. N78-18401
NELSON, W. E. N78-18952
NEUHAEUSER, H. G. N78-18015
NEVSKAYA, G. F. N78-18728
NICKEL, U. N78-18294
NIEDERSTADT, G. N78-18254
NIEHAUS, B. F. N78-18006
NIELSEN, J. N78-18235
NIELSEN, J. K. N78-18341
NIESZ, D. E. N78-18215

NISSIM, E. N78-18459
NITSCH, J. N78-18123
NORDMAN, G. W. N78-19044
NOVLAN, D. J. N78-18639
NOWACKI, J. P. N78-18234
NOWLIN, W. D. N78-18668
NUESCH, D. R. N78-18487
NUZILLAT, G. N78-18343
NYGAARD, K. J. N78-18420
NYHART, J. D. N78-18568
NYSTROEM, K. S. N78-18372

O

OBERDOERSTER, H. N78-18072
OCONNOR, R. P. N78-18501
N78-18502
OCONNOR, T. P. N78-18554
OIKAWA, M. N78-18935
OKAMOTO, Y. N78-18577
OLDING, S. E. N78-18980
OLDRIEVE, R. E. N78-18182
OLIVER, D. A. N78-18633
OLSEN, A. J. N78-18666
OPP, F. N78-18337
ORMOND, D. W. N78-18328
OSSAKOW, S. L. N78-18612
OSTOICH, V. N78-18916
OTIS, J. H. N78-18411
OTSUKA, M. N78-18933
OTTENSOSER, J. N78-18002
OWICKI, S. N78-18808

P

PACE, R. G. N78-18595
PAGANINIFIORATTI, M. N78-18889
PAGANO, N. J. N78-18139
PAGE, W. J. N78-18539
PAGLIETTI, A. N78-18243
PAKHOMOV, G. N. N78-18717
PALMIERI, J. V. N78-18359
PAN, F. P. N78-18184
PAN, K. N78-18328
PANIKAROVSKIY, V. V. N78-18717
PANKOVA, A. S. N78-18690
PANTELIDES, S. N78-18328
PAPADOPOULOS, L. N78-18344
PAPPERT, R. A. N78-18267
PAPPIS, J. N78-18101
PARK, Y. J. N78-18176
PARKER, J. A. N78-18127
PARKER, T. N78-18587
PARKINSON, D. B. N78-18138
PARKS, F. G. N78-18263
PARMLEY, R. T. N78-18251
PARTHASARATHY, S. P. N78-18396
PASOUR, J. A. N78-18336
PATTEE, H. E. N78-18393
PATTERSON, G. N. N78-18556
PAULIKAS, G. A. N78-19025
PAULSON, C. A. N78-18664
PAULSON, S. J. N78-18299
PEAKE, D. J. N78-18380
PEEBLES, L. H., JR. N78-18218
PEEPLES, M. L. N78-19003
PELKA, E. J. N78-18609
PELLICORI, S. F. N78-19013
PENNINGS, J. M. N78-18969
PERKINS, F. W., JR. N78-18412
PERKINS, G. S. N78-19041
PERKINS, J. N78-18186
PERNICK, B. J. N78-18854
PERONI, B. N78-18654
PERRIER, P. N78-18377
PERZYNA, P. N78-18238
PESTOV, I. D. N78-18684
PETERSEN, G. W. N78-18483
PETERSON, J. R. N78-18611
PETRASEK, A. C. N78-18992
PETRENKO, B. Y. N78-18724
PETROV, V. M. N78-18732
PETROVA, N. V. N78-18689
PETRUKHIN, S. V. N78-18747
PETTY, N. W. N78-18152
PEZZANO, H. N78-18891
N78-18892
PICKERING, L. N78-18271
PICKETT, R. B. N78-18033
PICKLESIMER, E. A. N78-18520
PIENING, M. N78-18109
PIERCE, F. J. N78-18361
PIERCE, H. N78-18158
PIERRON, L. N78-19033
PIETERSEN, O. B. M. N78-18289
PILECKI, S. N78-18232
PIMENOVA, M. V. N78-18759
PLATZOEDER, L. N78-18057
PLISOV, N. B. N78-18003
PODDUBNAYA, L. T. N78-18735
PODO, F. N78-18891
N78-18892
PODSYPANIN, F. V. N78-18795
POE, C. C., JR. N78-18135
POLYAKOV, B. I. N78-18691
N78-18724
POLYAKOV, G. N78-18089
POLYANSKIY, V. I. N78-18753
POMPHREY, R. B. N78-19018
PONAMAREV, S. I. N78-18719
PONOMAREV, V. B. N78-18927
POORE, M. F. N78-18843
POPE, D. P. N78-18517
PORTER, R. F. N78-18000
PORTUGALOV, V. V. N78-18689
N78-18731
POST, D. E. N78-18744
POTAPOV, P. P. N78-18940
POUBEAU, P. C. N78-18723
POWELL, W. W. N78-19043
POWER, J. L. N78-18800
POWERS, B. G. N78-18001
PRESSOUYRE, G. M. N78-18076
PRICE, D. N78-18175
PRICE, S. D. N78-18225
PRICE, W. L. N78-19014
PRISHCHEP, A. G. N78-18297
PROKHOCHUKOV, A. A. N78-18692
PRUKOP, G. N78-18717
PRYOR, R. A. N78-18154
PSIODA, J. A. N78-18516
PURAKHIN, Y. N. N78-18174
N78-18746

R

RABITZ, H. N78-18413
RAGOZIN, V. N. N78-18719
RAJU, B. B. N78-18360
RALSTON, L. M. N78-18401
RAMSEY, R. H., III N78-19003
RANLET, D. N78-18462
RAO, M. S. N78-18360
RAPOPORT, E. A. N78-18743
RASMUSSON, E. M. N78-18652
RATAJACK, M. T. N78-18906
RATHJEN, K. A. N78-18359
RAUDSEPS, J. N78-18026
RAVINDRANATH, A. N78-17995
RAYMOND, R. M. N78-18303
RAYNER, D. N78-18809
REBIBO, K. N78-19000
REDDY, K. C. N78-18007
REED, R. A. N78-18157
N78-19008
REEPS, S. M. N78-18767
REES, T. N78-19046
REID, L. D. N78-18077
REIMAN, A. H. N78-18257
REISER, J. N78-18697
REITER, E. N78-18618
REMEZOV, S. M. N78-18717
REMKE, R. L. N78-18947
REMPFER, P. N78-18026
RENARD, F. M. N78-18890
RENZ, W. N78-18899
REYNOLDS, B. N78-17995
RHIGER, D. R. N78-18954
RIBONI, R. N78-18114
RICCI, P. N78-18309
RICE, M. H. N78-18227
RICHARDS, W. E. N78-18909
RICHARDSON, P. C. N78-18703
RICHTER, B. J. N78-19032
RIDDER, G. M. N78-18155
RINGLAND, R. F. N78-18765
RINO, C. L. N78-18282
RISICA, S. N78-18706
ROBBINS, R. A. N78-18886
ROBERTS, P. O. N78-18547
ROBINSON, R. K. N78-18045
RODER, H. M. N78-18168
ROGANI, A. N78-18706
ROGATOVSKAYA, A. P. N78-18692
ROGERS, J. M. N78-18162
ROGERS, M. H. N78-18164
ROGERS, W. E. N78-18561
ROGULA, D. N78-18246
ROMANYUK, L. I. N78-18307
RONZHIN, L. P. N78-18250
ROPER, A. T. N78-18358
ROSEN, S. G. N78-18109
N78-18123
ROSENBLATT, M. N78-18430
ROSVOLD, W. C. N78-18398
ROTH, J. A. N78-18955
ROTH, M. N78-18577
ROWLEY, W. R. C. N78-18424
RUBIN, S. G. N78-17996
RUDNYY, N. M. N78-18681
N78-18684
RUIZ, C. N78-18470
RUNDELL, D. J. N78-18067
RUPPE, H. O. N78-18115
RUSSELL, C. B. N78-19003
RUSSELL, J. D. N78-18493
RUSSELL, W. J. N78-18199
RYKOWSKI, R. A. N78-18594

S

SABOE, E. P. N78-18705
SALAZKIN, V. N. N78-18725
SALZER, D. N78-18292
SANDFORD, M. C. N78-18394
SANDUSKY, G. T. N78-18069
SANTOSNEVESZUZARTETULLY, I. M. N78-18993
SARGISSON, D. F. N78-18066
SARKISOV, I. Y. N78-18682
SARNER, S. R. N78-18777
SARO, M. N78-18405
SATSUMA, J. N78-18935
SATYANARAYANA, B. N78-17999
SAVINA, Y. A. N78-18690
SAVVIN, A. B. N78-18724
SCHAUBERT, D. H. N78-18288
SCHEINER, B. H. N78-18329
SCHEININE, A. N78-18519
SCHER, R. B. N78-18818
SCHERER, K. N78-18702
SCHIESS, J. R. N78-18796
SCHILLER, W. L. N78-18806
SCHINDLER, R. A. N78-18391
N78-18395
SCHLEGEL, G. N78-18272
SCHLIEWA, M. N78-18072
SCHLINGMANN, S. N. N78-18597
SCHMIDT, G. K. N78-19040
SCHMIDT, H. P. N78-18109
SCHMIDT, L. V. N78-18005
SCHMITT, K. N78-18850
SCHMUCKER, R. H. N78-18110
N78-18115
N78-18121
N78-18122
N78-18124
N78-18126
N78-18964
SCHRECKER, H. N78-18072
SCHROTT, A. N78-18290
SCHUETZE, R. N78-18223
SCHUK, W. W. N78-18999
SCHULZ, P. A. N78-18888
SCHUSS, J. J. N78-18938
SCHUTTEN, R. N78-18915
SCHUTZ, W. N78-18049
SCOWEN, R. S. N78-18786
SEALS, J. N78-18711
SEGUR, H. C. O. N78-18633
SEILER, D. G. N78-18414
SELDEN, T. N78-18283
SELIVANENKO, V. T. N78-18754
SEN, A. K. N78-18932
SENGE, G. H. N78-18788
SENITZKY, I. R. N78-18422
SEREBRENNIKOV, M. I. N78-18691
SEROVA, L. V. N78-18683
N78-18742
SERRANO, C. M. N78-18328
SEYFULLA, R. D. N78-18687
SHAARAWY, H. S. N78-18856
SHALNEV, B. I. N78-18686
SHANER, J. W. N78-18200
SHAPIRO, G. N. N78-18322
SHARECK, M. W. N78-18401
SHARMA, J. N78-18578
SHATZKES, M. N78-18328
SHAU, G. C. N78-18059
SHAU, G. S. N78-18109
SHAW, H. H. N78-18455
SHAWCROFT, R. G. N78-19005
SHAWCROSS, J. P. N78-18353
SHCHERBAKOVA, M. N. N78-18756
SHEFFIELD, G. S. N78-18963
SHELAR, E. N78-18618
SHEN, Y. R. N78-18888
SHEPARD, L. A. N78-18214
SHEPPARD, C. J. R. N78-18917
N78-18918
N78-18919
N78-18920
SHERRER, V. C. N78-18078
SHICK, I. C. N78-18434
SHIH, K., SR. N78-18521
N78-18525
SHIH, S. M. N78-18346
SHIPOV, A. A. N78-18682
SHIRATORI, M. N78-18470
N78-18471
N78-18473
SHOLTIS, J. A. N78-18898
SHORT, R. D. N78-18270
SHOU, J. K. N78-18560
SHRAGER, J. J. N78-18021
SHRIVER, E. L. N78-18390
SHUBICH, M. G. N78-18722
SHULZHENKO, Y. B. N78-18733
SHUMAKOV, V. I. N78-18686
SHUMSHUROV, V. I. N78-18732
SHVETS, V. N. N78-18731

SIDIK, S. M. N78-18429
SIDOROV, O. Y. N78-18734
SIEGEL, A. F. N78-18857
SIELAND, T. E. N78-18622
SIMONCIC, A. A. N78-18576
SIMONOV, Y. Y. N78-18752
SIMPSON, J. J. N78-18664
SINDLINGER, R. S. N78-19031
SINGH, A. K. N78-18860
SINGH, C. N78-18454
SINGH, J. J. N78-18572
N78-18796
SINHA, A. N. N78-18036
SIRIEIX, M. N78-18376
SKORIK, A. S. N78-18728
SKUDRIDAKIS, J. N78-18011
SLOBODCHUK, Y. S. N78-18759
SMALL, M. J. N78-18575
SMALLEY, A. J. N78-18460
SMIRL, A. L. N78-18956
SMIRNOVA, T. A. N78-18748
SMITH, A. B. N78-18957
SMITH, B. W. N78-18409
SMITH, E. D. N78-19003
SMITH, G. R. N78-18623
SMITH, H. A. N78-18761
SMITH, J. H. B. N78-18384
SMITH, K. K. N78-18162
SMITH, R. D. N78-18565
SMITH, W. O. N78-18281
SNOWDEN, D. P. N78-18317
SOCIE, D. F. N78-18451
SOEDERLIND, G. N78-18855
SOICHER, H. N78-18268
SOJKA, R. J. N78-18302
SOLODOVNIK, F. A. N78-18736
SONDERFELD, A. T. N78-18708
SORIANO, J. A. N78-18127
SOVA, J. A. N78-18135
SPENCER, R. A. N78-19036
SPIECKER, R. G. N78-18914
SPITLER, M. T. N78-18949
SPOFFORD, C. W. N78-18875
SPRINGETT, J. C. N78-18259
SRINATHKUMAR, S. N78-18823
STAFEROV, V. A. N78-18754
STALEY, W. W. N78-18321
STAMPER, K. R. N78-18437
N78-18439
STAMULIS, A. N78-18579
STANDING, J. M. N78-19046
STANGE, W. C. N78-19034
STANGEBY, P. C. N78-18896
STAPLETON, R. N78-18034
N78-18039
STARKUS, C. J. N78-19037
STASKIN, E. R. N78-18975
STATTENFIELD, D. B. N78-18538
STAUB, F. N78-18201
STAZHADZE, L. L. N78-18741
STECURA, S. N78-18355
STEELE, S. R. N78-18334
N78-18335
STEERS, S. T. N78-18075
STEIN, R. E. N78-18568
STEIN, V. N78-18291
STELZEL, F. N78-18035
STEPHANAKIS, S. J. N78-18887
STEPHENS, D. G. N78-18873
STEPHENS, M. L. N78-18398
STETTER, J. R. N78-18224
STEVENS, H. L. N78-18070
STEVENSON, L. N78-18026
STEVENSON, M. B. N78-18982
STEWART, G. W. N78-18841
STEWART, O. W. N78-18560
STIEGLITZ, R. A. N78-18875
STOCK, H. W. N78-18010
STODDARD, F. J. N78-18071
STOENESCU, M. L. N78-18939
STONE, W. P. N78-18213
STORM, G. A. N78-18186
N78-18191
STOTLER, C. L., JR. N78-18066
STOUGH, H. P., III N78-18044
STRANGIO, C. N78-18425
STRAUSS, P. N78-18517
STROM, L. D. N78-18332
STROUPE, R. C. N78-18147
STURSBERG, K. N78-18298
STUTZ, J. N78-18814
SUAVILNYY, N. Y. N78-18307
SUDBO, A. S. N78-18888
SUELZLE, J. S. N78-18327
SUELZLE, L. R. N78-18327
SUGIHARA, R. N78-18930
SULIMO-SAMUYLLO, Z. K. N78-18734
SULLIVAN, J. W. N78-18427
SUNG, H. N. N78-18950
SURLAND, P. N78-18916
SURRIDGE, R. G. N78-18984
SUTHERLAND, J. E. N78-18512
SUTTNER, K. N78-19040
SUTULA, R. A. N78-18325
SWANSON, L. W. N78-18776
SWEATT, W. C. N78-18389
SWEAZY, R. M. N78-18429
SWEET, G. E. N78-18734
SYMONDS, P. S. N78-18857
SYRYKH, G. D. N78-18622
N78-18576
SZANIAWSKI, A. N78-18752
SZETO, R. K. N78-18664

T

TABET, E. N78-19031
TAI, M. H. N78-18860
TAKESHITA, A. N78-18454
TANAKA, S. N78-18572
TARASOV, I. K. N78-18796
TARJAN, R. E. N78-18036
TARKHANOVSKIY, V. N78-18376
TARKO, A. M. N78-18728
TARTER, C. B. N78-18011
TAYLOR, H. F. N78-18759
TAYLOR, J. G. N78-18575
TAYLOR, K. N78-18460
TAYLOR, L. E. N78-18956
TAYLOR, M. L. N78-18748
N78-18957
TAZETDINOV, I. G. N78-18409
TELENIN, G. F. N78-19003
TELLEFSEN, K. N78-18623
TELTSOV, M. V. N78-18761
TERASHIMA, Y. N78-18384
TERRANOVA, T. N78-18162
TERRAY, D. E. N78-18565
TERUMICHI, Y. N78-18281
TESCHE, F. M. N78-18317
TESKE, M. E. N78-18451
TEWELL, J. R. N78-18855
THEBERGE, N. N78-18268
THIBODEAU, L. A. N78-18302
THIELE, G. A. N78-18736
THOMAE, S. C. N78-18708
THOMAS, C. L. N78-18127
THOMAS, R. R. N78-18135
THOMPSON, G. L. N78-19036
THOMPSON, J. R., JR. N78-18914
THOMPSON, P. B. N78-18949
TIERNEY, W. T. N78-18875
TIGHE, R. J. N78-18259
TIGRANYA, R. A. N78-18823
TIGRANYAN, R. A. N78-18754
TIKHOMIROV, I. B. N78-18321
TIKHONOV, M. A. N78-18437
TIPLER, H. R. N78-18439
TIRRELL, M. V. N78-18579
TODA, H. N78-19046
TOLER, J. N78-19034
TOMASELLI, V. P. N78-18896
TOMLINSON, H. M. N78-18034
TORONTO, A. N78-18039
TOSCH, T. J. N78-19037
TOWNSEND, W. L. N78-18975
TRAN, M. D. N78-18538
TREADAWAY, M. J. N78-18201
TREANOR, J. J. N78-18741
TREUPEL, H. W. N78-18355
TRIEBSTEIN, H. N78-18334
TROTTER, J. N78-18335
TROUBETZKOY, E. S. N78-18075
TROWBRIDGE, D. L. N78-18568
TRUDEAU, N. R. N78-18291
TRUSSELL, H. J. N78-18035
TSAKIRIS, G. D. N78-18887
TSIKOUDI, V. N78-18873
TSIVILASHVILI, A. S. N78-18398
TSYGANOVA, N. I. N78-18224
TUCHOLSKI, T. N78-18070
TUCKER, H. L. N78-18026
TURCHANINOVA, V. F. N78-18982
TURNER, J. A. N78-18841
TURNER, J. H. N78-18560
TWEDELL, D. B. N78-18875
N78-18010
N78-18071
N78-18939
N78-18213
N78-18186
N78-18191
N78-18066
N78-18044
N78-18425

U

N78-18517
UDA, R. T. N78-18332
UDALOV, S. N78-18147
UGLOVA, N. N. N78-18298
UHLMANN, D. R. N78-18814
ULLMAN, J. E. N78-18307
ULVILA, J. W. N78-18888
N78-18327
N78-18327
USKOV, F. N. N78-18930
UTKIN, V. N. N78-18734
UYEHARA, O. A. N78-18427
N78-18950
N78-18916
N78-18984
N78-18512

V

VAKAR, M. I. N78-19040
VANBLARICUM, P. J. C. N78-18325
VANCLEEMPUT, W. M. N78-18776
N78-18389
VANDENDOOL, H. M. N78-19003
VANDERVET, W. J. N78-18475
VANDERWILT, M. N78-18209
VANEGMOND, J. A. N78-18464
VANGOOL, M. F. C. N78-18684
VANTRIET, A. N78-18695
VARMA, R. K. N78-18233
VARNELL, G. L. N78-18008
VARNER, R. N. N78-18056
VASILYEV, L. N78-18009
VASILYEV, P. V. N78-18080
N78-18709
N78-18202
N78-18886
N78-18811
N78-18357
N78-18684
N78-18716
N78-18747
N78-18706
VASILYEVA, T. D. N78-18718
N78-19007
VERIGO, V. V. N78-18688
N78-18678
VERNIKOV, Y. N. N78-18692
VEVERKA, A. N78-18929
VIG, J. R. N78-18310
VINE, J. N78-18695
VIVIAND, H. N78-18958
VLASOV, V. D. N78-18905
VOICULESCU, I. A. N78-18378
VOLYNKIN, Y. M. N78-18693
VONISSENDORFF, H. N78-18143
VONPUTTKAMER, J. N78-18686
VOROBYEV, Y. I. N78-18816
VOYTKOVYAK, M. N78-18091
VYKUKAL, H. C. N78-18680
N78-18737
N78-18763

W

WAGNER, T. J. N78-18778
WAKATANI, M. N78-18942
WALCH, S. P. N78-18156
WALKER, C. C. N78-18972
WALKER, H. F. N78-18871
WALKER, W. N78-18842
WALKLEY, K. B. N78-17994
WALLENIUS, K. T. N78-18848
N78-18859
WALLIS, R. F. N78-18959
N78-18960
WALLMARK, G. N. N78-18399
WALSH, D. N78-18917
N78-18918
N78-18919
WALSH, P. M. N78-18951
WALTON, B. L. N78-18535
WANG, H. C. N78-18794
WANG, J. N78-18577
WANG, J. R. N78-18496
WARD, D. W. N78-18873
WARNER, I. M. N78-18142
WARNER, S. B. N78-18218
WASCH, R. B. A. N78-18289
WATANABE, S. N78-18928
WATERS, K. T. N78-17990
WAYMAN, C. M. N78-18189
WEAVER, R. P. N78-19015
WEBB, G. L. N78-18862
WEBER, C. L. N78-18118
WECK, M. N78-18072
WEI, J. P. N78-18351
WEILAND, J. N78-18931
WEINER, H. N78-18558
WEISS, R. O. N78-18453
WELCH, A. J. N78-18703
WELCH, B. H. N78-19032
WELL, K. H. N78-18059
WELLNER, P. N78-18201
WELLS, D. M. N78-19003
WELLS, M. G. H. N78-18196
WENK, A. F. N78-18061
WENTZ, F. J. N78-18662
WERNER, C. N78-18296
N78-18646
WESSELS, H. R. A. N78-18647
WEST, J. N78-18120
WESTERDAHL, C. A. L. N78-18199
WESTERFIELD, R. M., JR. N78-18698
WHARTON, L. N78-18160
WHEELER, D. B. N78-18119
WHITE, P. J. N78-18180
WHITLEY, R. M. N78-18901
WHITT, F. J. N78-18269
WHITWORTH, T., III N78-18668
WIENSCH, R. E. N78-18095
WIHL, M. N78-18519
WIIN-NIELSEN, A. N78-18650
WILE, D. N78-18802
N78-18825
WILHELMSSON, H. N78-18931
WILKINS, R. D. N78-18485
WILLIAMS, J. C. N78-18194
N78-18195
N78-18196
WILLIAMS, K. G. N78-18400
WILLIAMS, L. J. N78-18540
WILLIAMS, S. D. N78-18364
WILLIAMS, T. E. N78-18673
WILLIAMS, W. R. N78-18226
WILLIAMSON, R. A. N78-18886
WILLIAMSON, R. L. N78-18764
WILSON, R. F. N78-18533
WINBORN, C. D. N78-18886

WINNER, R. N. N78-18062
WISE, T. E. N78-18313
WISSMAN, D. J. N78-18704
WITBRACHT, L. N78-18108
WITKOWSKI, R. E. N78-18253
WITT, J. H. N78-18791
WITT, R. N78-18055
WODKIEWICZ, K. N78-18902
WOLF, M. N78-18517
WOLFE, J. N78-18771
WOLFF, M. N78-19013
WOLFSON, G. N78-18333
WONG, K. L. N78-18800
WOOD, T. E. N78-18213
WOOLARD, H. W. N78-18006
WOZNIAK, C. N78-18237
WROBEL, T. F. N78-18317
WU, F. K. N78-18350
WU, J. M. N78-18007

Y

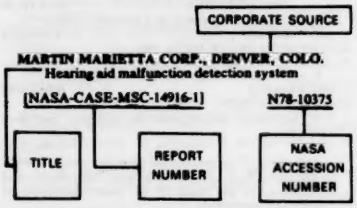
YAGHJIAN, A. D. N78-18287
YAJIMA, N. N78-18935
YAKOVLEVA, I. Y. N78-18695
YANAWAY, A. N78-18661
YAO, S. N78-18131
YARIV, A. N78-18910
YARRINGTON, R. N78-18999
YARULLIN, K. K. N78-18718
YEGOROV, A. D. N78-18680
YEGOROV, B. B. N78-18680
YEGOROV, I. A. N78-18742
YEOW, Y. T. N78-18132
YEREMIN, A. V. N78-18684
N78-18740
YOHE, W. C. N78-18179
YOLTON, C. F. N78-18194
N78-18195
YOLTON, L. F. N78-18196
YOUNG, D. R. N78-18328
YOUNG, N. E. N78-18760
YOUNG, W. H., JR. N78-18084
YUEN, H. P. N78-18280
YUNUSOVA, L. S. N78-18729

Z

ZARDIACKAS, L. D. N78-18178
ZEITLER, G. N78-18228
ZIMMER, R. P. N78-18485
ZIMMERMANN, K. N78-18094
ZORNIG, J. G. N78-18877
ZUMWALDE, R. D. N78-18591
ZYBIN, O. K. N78-18687

CORPORATE SOURCE INDEX

Typical Corporate Source Index Listing



Listings in this index are arranged alphabetically by corporate source. The title of the document provides the user with a brief description of the subject matter. The report number helps to indicate the type of document cited (e.g., NASA report, translation, NASA contractor report). The NASA accession number denotes the number by which the citation is identified. The titles are arranged under each corporate source in ascending accession number order.

A

ABEX CORP., OXNARD, CALIF.
Reliability, Improvement Warranty [RIW] mid contract evaluation
[AD-A048244] N78-18441

ADVISORY GROUP FOR AEROSPACE RESEARCH AND DEVELOPMENT, PARIS [FRANCE].
Fatigue design of fighters: Guidelines for obtaining and maintaining adequate fatigue performance of tactical aircraft
[AGARD-AG-231] N78-18046
Applications of non-intrusive instrumentation in fluid flow research
[AGARD-AR-112] N78-18374
Three Dimensional and Unsteady Separation at High Reynolds Numbers
[AGARD-LS-94] N78-18375
Assessing pilot workload
[AGARD-AG-233] N78-18770

AEG-TELEFUNKEN, BACKNANG [WEST GERMANY].
Concepts for the realization of TV broadcasting satellite
N78-18103

AEROCHEM RESEARCH LABS., INC., PRINCETON, N. J.
Synthesis of silane and silicon in a non-equilibrium plasma jet
[NASA-CR-155933] N78-18518

AERONAUTICAL RESEARCH ASSOCIATES OF PRINCETON, INC., N. J.
Low-level, atmospheric turbulence model for marine environments
[AD-A047980] N78-18633

AERONAUTICAL RESEARCH INST. OF SWEDEN, STOCKHOLM.
Flexnozzle steering of a fluid jet
[FFA-MEMO-114] N78-18372

AEROSPACE CORP., EL SEGUNDO, CALIF.
Analytic solution for the equilibrium composition of a carbon-nitrogen-oxygen gas mixture
[AD-A048597] N78-18161
Estimates of turbulent boundary layer behind a shock wave moving with uniform
[AD-A048445] N78-18369
Fault-tolerant software for aircraft control systems
[NASA-CR-145298] N78-18797
Energetic electrons at the synchronous altitude, 1974 - 1977
[NASA-CR-155775] N78-19025

AEROSPACE CORP., LOS ANGELES, CALIF.
Intercity rail energy intensity for passenger movement
N78-18546
Energy intensity of various transportation modes
N78-18555

AIR FORCE AVIONICS LAB., WRIGHT-PATTERSON AFB, OHIO.
A star scene simulator for test and evaluation of imaging systems used in point-source detection
[AD-A048201] N78-18095
Rooftop antenna pointing program
[AD-A047999] N78-18111
Test facility for television sensors applied to the detection of satellites
[AD-A048189] N78-18112
Efficient multiple processor coordination
[AD-A048195] N78-18775
Specklegram data reduction using optical and digital techniques
[AD-A048210] N78-18907

AIR FORCE FLIGHT DYNAMICS LAB., WRIGHT-PATTERSON AFB, OHIO.
Cambered jet-flapped airfoil theory with tables and computer programs for application
[AD-A048528] N78-18006
NASTRAN stress recovery package
[AD-A048744] N78-18467
Ten-place tables of the Voigt and growth functions
[AD-A047871] N78-18840

AIR FORCE GEOPHYSICS LAB., HANSCOM AFB, MASS.
Adaptive mapping of mid-latitude ionosphere
[AD-A048116] N78-18607
Correlation distance of mean daytime electron content
[AD-A048117] N78-18608
The distribution of thunderstorm days, lightning discharges, and the incidence of lightning discharge derived from VLF sferics data
[AD-A048271] N78-18634
Short arc reduction of radar altimetry computer program
[NASA-CR-141434] N78-18798
The AFGL four color infrared sky survey: Supplemental catalog
[AD-A048048] N78-19014

AIR FORCE HUMAN RESOURCES LAB., BROOKS AFB, TEX.
Audio-visual proficiency testing: Annotated bibliography
[AD-A048122] N78-18704

AIR FORCE INST. OF TECH., WRIGHT-PATTERSON AFB, OHIO.
The effects of external stores on the flutter of a non-uniform cantilever
[AD-A048360] N78-18078
Effects of gamma radiation on gallium-arsenide lasers
[AD-A048361] N78-18418
Comparison of developing versus non-developing tropical disturbance
[AD-A047789] N78-18632
Automatic generation of segmentation directives on the CDC 6600 computer
[AD-A047782] N78-18777
Direct solutions of large, sparse linear systems
[AD-A047776] N78-18843
An algorithmic approach for reducing kinematically similar differential systems
[AD-A047781] N78-18845
Approximation of zeros of functions arising in the engineering sciences
[AD-A047783] N78-18846

AIR FORCE MATERIALS LAB., WRIGHT-PATTERSON AFB, OHIO.
Stress fields in composite laminates
[AD-A048565] N78-18139

AIR FORCE SYSTEMS COMMAND, WRIGHT-PATTERSON AFB, OHIO.
Investigation of aerodynamic characteristics of V-wings near solid surface
[AD-A048555] N78-18003
The movement of a wing with deflected ailerons close to a screen
[AD-A048651] N78-18004
The development of fatigue/crack growth analysis loading spectra
N78-18048
Reliability of welded joints and structures [selected articles]
[AD-A048336] N78-18442
Transactions of the 8th All-Union Conference on cloud physics and active modifications [selected articles]
[AD-A048653] N78-18637
Use of the MA-48L iterative analog computer in control system designing
[AD-A048559] N78-18827
Interactions of high-energy particles and Atomic Nuclei with Nuclei, chapter 7 thru 11
[AD-A048311] N78-18885

AIR FORCE WEAPONS LAB., KIRTLAND AFB, N. MEX.
Modeling of high current injection into bipolar semiconductors
[AD-A048781] N78-18330
Safety methodology for space nuclear systems
[AD-A048780] N78-18898

AIR POLLUTION TECHNOLOGY, INC., SAN DIEGO, CALIF.
Gas-atomized spray scrubber evaluation
[PB-274449/8] N78-18589

ALABAMA UNIV., UNIVERSITY.
Planning for Materials Processing in Space
[NASA-CR-155786] N78-18090

ALASKA UNIV., FAIRBANKS.
Application of remote sensing data to surveys of the Alaskan environment
[E78-10077] N78-18486

AMERICAN INST. OF AERONAUTICS AND ASTRONAUTICS, NEW YORK.
Accessing numeric data via flags and tags: A final report on a real world experiment
[NASA-TM-79326] N78-18975

AMERICAN SOCIETY OF INTERNATIONAL LAW, WASHINGTON, D. C.
Ocean thermal energy conversion: Legal, political, and institutional aspects
[PB-274123/9] N78-18568

ANALYTICAL AND COMPUTATIONAL MATHEMATICS, INC., HOUSTON, TEX.
Satellite orbit computation methods
[NASA-CR-151600] N78-18096

ANDROS, INC., BERKELEY, CALIF.
A sensor for the detection of CO2 in hyperbaric gaseous environments
[AD-A048599] N78-18400

APPLI-MATION, INC., SAN DIEGO, CALIF.
Automated weapon system trainer: Expanded adaptive module for basic instrument flight maneuvers
[AD-A048498] N78-18087

ARIZONA UNIV., TUCSON.
Designing holographic optical elements
N78-18389

ARMY AEROMEDICAL RESEARCH UNIT, FORT RUCKER, ALA.
The helmet protects the aviator's head - or does it
[AD-A048574] N78-18766

ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND, DOVER, N. J.
Characterization of chromic-acid anodized 2024-T3 aluminum adherends
[AD-A048756] N78-18199
Charcoal regeneration. Part 1: Mechanism of TNT adsorption
[AD-A048757] N78-18578

ARMY AVIATION ENGINEERING FLIGHT ACTIVITY, EDWARDS AFB, CALIF.
Airworthiness evaluation NUH-1H helicopter with global positioning system
[AD-A047971] N78-18053

ARMY AVIATION RESEARCH AND DEVELOPMENT COMMAND, MOFFETT FIELD, CALIF.
Aeromechanical stability of helicopters with a bearingless main rotor. Part 1: Equations of motion
[NASA-TM-78459] N78-18043

ARMY ELECTRONICS COMMAND, FORT MONMOUTH, N. J.
Prediction of transionospheric signal time delays using correlative techniques
[AD-A047917] N78-18268
Low profile antenna performance study. Part 3: Bibliography
[AD-A047991] N78-18273
Low profile antenna performance study. Part 2: Broadband antenna techniques survey
[AD-A047992] N78-18274

Four-point mounting configuration for resonators subjected to severe environments
[AD-A048069] N78-18326
Chemically polished quartz
[AD-A048077] N78-18958
ARMY ELECTRONICS COMMAND, WHITE SANDS MISSILE RANGE, N. MEX.
The 1481BC lance missile number 3292, round number 298 APT, 24 August 1977
[AD-A048321] N78-18640
Meteorological data report. 12828F Lance missile no. 2215, round no. 302 RSL, 6 October 1977
[AD-A048273] N78-18642
Meteorological data report. 14821A Lance missile no. 3296, round no. 303 APT, 10 November 1977
[AD-A048272] N78-18643
ARMY ENGINEER WATERWAYS EXPERIMENT STATION, VICKSBURG, MISS.
An example of appyling remote sensing to a Corps of Engineers archeological problem
[AD-A048106] N78-18503
Investigation of remote water-quality monitoring systems for use with GOES or ERTS water data transmitter
[AD-A047795] N78-18574
Earthquake resistance of earth and rock-fill dams. Report 5: Permanent displacements of earth embankments by Newark sliding block analysis
[AD-A048346] N78-18610
ARMY MATERIALS AND MECHANICS RESEARCH CENTER, WATERTOWN, MASS.
Titanium diboride electrodeposited coatings
[AD-A047956] N78-18214
Survey of ceramic refractory problems and materials shortages
[AD-A048108] N78-18216
Residual stresses in an anisotropic thick hollow cylinder of chemically vapor-deposited material due to uniform cool-down
[AD-A048301] N78-18465
ARMY MATERIALS RESEARCH AGENCY, WATERTOWN, MASS.
Flammability assessment tests for organic materials: The oxygen index/temperature index concept
[AD-A047830] N78-18159
ARMY MATERIEL DEVELOPMENT AND READINESS COMMAND, ALEXANDRIA, VA.
Joint design-to-cost guide. Life cycle as a design parameter
[AD-A048254] N78-18965
ARMY MATERIEL SYSTEMS ANALYSIS ACTIVITY, ABERDEEN PROVING GROUND, MD.
A goodness-of-fit test for a class of nonhomogeneous Poisson processes
[AD-A048180] N78-18844
ARMY MEDICAL BIOENGINEERING RESEARCH AND DEVELOPMENT LAB., FORT DETRICK, MD.
The hazard ranking and allocation methodology: Assembly of the hazard ranking and allocation methodology: Assembly of the hazard estimation data base for air and surface water pollutants
[AD-A047826] N78-18575
ARMY MOBILITY EQUIPMENT RESEARCH AND DEVELOPMENT CENTER, FORT BELVOIR, VA.
Comparison tests on the 100-GPM electrokinetic fuel decontaminator and a 100-GPM military standard filter/separator
[AD-A048655] N78-18226
ARMY TROPIC TEST CENTER, APO NEW YORK 09827.
A new approach toward obtaining quantified subjective test data
[AD-A047838] N78-18764
ATMOSPHERIC SCIENCES LAB., WHITE SANDS MISSILE RANGE, N. MEX.
White Sands Missile Range climate calendar
[AD-A048305] N78-18639
ATOMIC ENERGY COMMISSION, DACCA [BANGLADESH].
Investigations using data from LANDSAT 2
[E78-10080] N78-18489
AUERBACH ASSOCIATES, INC., PHILADELPHIA, PA.
Chemical use classification system
[PB-275106/3] N78-18129
AVCO-EVERETT RESEARCH LAB., EVERETT, MASS.
Laser absorption phenomena in flowing gas devices
[NASA-CR-135129] N78-18411
AVCO SYSTEMS DIV., WILMINGTON, MASS.
Structural analysis and testing for composite flywheel development
[AD-A048076] N78-18137
AVIONS MARCEL DASSAULT-BREGUET AVIATION, SAINT-CLOUD [FRANCE].
Separation problems encountered by aircraft designers csa Div. des Etudes Avancees.
N78-18377
Cartridge firing device designed for attachment, release and ejection of a satellite
N78-19033
AXIOMATIX, MARINA DEL REY, CALIF.
Space shuttle proximity operation sensor study
[NASA-CR-151634] N78-18118
IUS/payload communication system simulator configuration definition study
[NASA-CR-151620] N78-18259

B

BATTELLE COLUMBUS LABS., OHIO.
Analytical study of a free-wing/free-trimmer concept
[NASA-CR-2946] N78-18000
Strength analysis of brittle materials
[AD-A048188] N78-18215
Attaching of strain gages to substrates
[NASA-CASE-FRC-10093-1] N78-18393
Laser pulse speckle effects
[AD-A048598] N78-18421
Meteorological satellite observations and Army operations
[AD-A048157] N78-18636
BDM CORP., VIENNA, VA.
Preliminary analysis of an option for the Federal photovoltaic utilization program
[PB-274220/3] N78-18562
BENDIX CORP., COLUMBIA, MD.
Microwave dichroic plate
[NASA-CASE-GSC-12171-1] N78-18313
BIRMINGHAM LIBRARIES COOPERATIVE MECHANISATION PROJECT [ENGLAND].
File organisation and access techniques. A selective bibliography
[BLL-BLRDR-5414-[2113.56F]]
N78-18981
BOEING AEROSPACE CO., HOUSTON, TEX.
Method and apparatus for eliminating luminol interference material
[NASA-CASE-MSC-16260-1] N78-18674
BOEING COMMERCIAL AIRPLANE CO., SEATTLE, WASH.
Fuselage structure using advanced technology metal matrix fiber reinforced composites
[NASA-CASE-LAR-11688-1] N78-18045
BOEING VERTOL CO., PHILADELPHIA, PA.
Research requirements to reduce maintenance costs of civil helicopters
[NASA-CR-145288] N78-17990
Limitations of the CH-47 helicopter in performing terrain flying with external loads
[AD-A048580] N78-18054
BRIGHAM YOUNG UNIV., PROVO, UTAH.
Real-time computer optimized scanning potential coulometry for multi-component trace analysis
N78-18152
BRITISH LIBRARY LENDING DIV., BOSTON SPA [ENGLAND].
Indexing of structural data on chemical compounds in British universities
[BLL-BLRDR-5355-[2113.56F]]
N78-18982
Developing an acquisitions system for a university library
[BLL-BLRDR-5351] N78-18983
BROWN UNIV., PROVIDENCE, R. I.
Experiments on dynamic plastic loading on frames
[AD-A048687] N78-18464
Significant achievements in the planetary program, 1976 - 1977
[NASA-CR-2956] N78-19022
BUREAU OF ECONOMIC ANALYSIS, WASHINGTON, D. C.
Measuring the impact on scheduled air lines operations of restrictions in fuel availability
N78-18549
BUREAU OF LANDING MANAGEMENT, WASHINGTON, D. C.
Proposed increase in oil and gas leasing on the outer continental shelf, volume 1
[PB-273700/5] N78-18506
Proposed increase in oil and gas leasing on the outer continental shelf, volume 2
[PB-273701/3] N78-18507
Proposed increase in oil and gas leasing on the outer continental shelf, volume 3
[PB-273702/1] N78-18508
Conservation districts and 208 water quality management: Non-point source identification and assessment, selection of best management practices, management agencies, regulatory programs
[PB-274411/8] N78-19001
BUREAU OF MINES, WASHINGTON, D. C.
Manganese - 1977
[PB-274070/2] N78-18205
The United States energy scene 1976-1985
N78-18530
Energy consumption in the transportation sector
N78-18531
BUREAU OF RECLAMATION, DENVER, COLO.
Atmospheric simulation using stratified liquid models
[PB-274529/7] N78-18658

C

CABOT CORP., KOKOMO, IND.
Investigation of processing microstructures and properties of oxide dispersion strengthened cobalt alloy extruced shapes
[AD-A048593] N78-18198
CALIFORNIA INST. OF TECH., PASADENA.
Theoretical studies of chemisorption
N78-18156
Electrooptic phenomena and devices in gases
[AD-A048328] N78-18910
CALIFORNIA STATE DEPT. OF TRANSPORTATION, SACRAMENTO.
Nondestructive inspection of steel, phase 1
[PB-274495/1] N78-18445
CALIFORNIA UNIV., BERKELEY.
A numerical investigation of confined turbulent shear flows
N78-18356
Velocities of compressional wave in rocks of central California at high pressure and high temperature and applications to the study of the crustal structure of California coast ranges
N78-18606
Numerical experiments concerning the eigenvalues of the Laplacian on a Zoll surface
N78-18836
Electron transfer at sensitized semiconductor electrodes
N78-18949
CALIFORNIA UNIV., BERKELEY. LAWRENCE BERKELEY LAB.
Molecular beam studies on multiphoton dissociation of polyatomic molecules
[LBL-6275] N78-18888
CALIFORNIA UNIV., DAVIS.
Effect of temperature and cross-linkings on the flow behavior of a rubberized epoxy resin
[UCRL-13732] N78-18220
The design and evaluation of a two-phase turbine for low quality steam-water mixtures
N78-18426
CALIFORNIA UNIV., IRVINE.
Inductive extrapolation: A system for program synthesis from exemplary data employing regular grammar inference and polynomial separation of machine states
N78-18789
Theory of surface polaritons in n-InSb in the presence of a DC current and an external DC magnetic field
[AD-A048217] N78-18959
Theory of bound states associated with n-type inversion layers on silicon
[AD-A048216] N78-18960
CALIFORNIA UNIV., LIVERMORE. LAWRENCE LIVERMORE LAB.
Thermophysical measurements on liquid metals above 4000 K
[UCRL-78782] N78-18200
CALIFORNIA UNIV., LOS ANGELES.
The formation and stability of longitudinal roll vortices in shear flows
[AD-A048691] N78-18367
A new model of nerve action potential and the existence of a pulse solution
N78-18676
Periodic optimization and controllability of periodic control systems
N78-18821
CALIFORNIA UNIV., RIVERSIDE.
Heat flow in a geothermally active area: The Geysers, California
N78-18602
Generalized stochastic network and statistical decision analysis
N78-18856
CALSPAN CORP., BUFFALO, N. Y.
Studies of heat transfer to gas turbine components
[AD-A048551] N78-18071
CAMBRIDGE UNIV. [ENGLAND].
Segregation effects and the toughness of high-strength steels
[AD-A048448] N78-18193
CARNEGIE-MELLON UNIV., PITTSBURGH, PA.
The effect of microstructure and strength on the fracture toughness of an 18 Ni, 300 grade maraging steel
N78-18174
The role of trapping on hydrogen transport and embrittlement
N78-18175
Mechanism of cleavage fracture in pearlitic eutectoid steel
N78-18176
The influence of thermomechanical processing on the microstructure of metastable beta-Ti alloys
[AD-A048771] N78-18194
Some observations on the structure of Ti-11.5Mo-6Zr-4.5Sn [beta 3] as affected by processing history
[AD-A048772] N78-18195

The relationship between the microstructure and age hardening response in the metastable beta titanium alloy Ti-11.5Mo6Zr-4.5Sn [beta 3]
[AD-A048773] N78-18196
Towards a framework of organizational effectiveness
[AD-A047966L] N78-18969
An experiment on executive decision making
[AD-A047888L] N78-18970

CARSON ALEXIOU CORP., NORWALK, CONN.
Electron beam recorder applications study
[AD-A048666] N78-18399

CASE WESTERN RESERVE UNIV., CLEVELAND, OHIO.
Parameter studies relative to an electric field-induced dipole moment laser
[AD-A048327] N78-18417
Effect of surface texture by ion beam sputtering on implant biocompatibility and soft tissue attachment
[NASA-CR-135311] N78-18672

CATHOLIC UNIV. OF AMERICA, WASHINGTON, D. C.
A theoretical investigation of spread spectrum modulation concepts and performance
N78-18258
An investigation of the bearing accuracy of two passive multi-channel array algorithms in the presence of correlated noise
N78-18791

CENTRAL ELECTRICITY RESEARCH LABS., LEATHERHEAD [ENGLAND].
The decision table approach to reliable software
N78-18815

CENTRE NATIONAL DE RECHERCHES DE L'ESPACE, BRUSSELS [BELGIUM].
Report presented to the 20th COSPAR General Assembly
N78-18616

CHICAGO UNIV., ILL.
An analysis of three weather-related aircraft accidents
[NASA-CR-155363] N78-18024
Gas surface interactions
[AD-A048667] N78-18160
Meteorological satellite observations and Army operations
[AD-A048157] N78-18636

CINCINNATI UNIV., OHIO.
A two dimensional MHD model for magnetic field line reconnection in an incompressible and inviscid plasma
N78-18604

CITY UNIV. OF NEW YORK.
Evoked cortical potentials and information processing
[AD-A048647] N78-18760

CLEMSON UNIV., S.C.
Elastic-plastic analysis of a rolling disk by finite elements
N78-18455
General considerations on the design of an interactive system for data analysis
[AD-A048248] N78-18801
Constraints in the design and implementation of interactive statistical systems for minicomputers
[AD-A048124] N78-18803
Approximation of a completely monotone function
[AD-A048249] N78-18842
On a generalization of Freund's bivariate failure model
[AD-A048152] N78-18847
TSA: Statistical programs for interactive time series analysis
[AD-A048151] N78-18848
Distribution of sample correlation coefficients
[AD-A048126] N78-18849
Component-wise minimax property of Stein's rule
[AD-A048125] N78-18851
Distribution of a sum of order statistics from the gamma distribution
[AD-A048127] N78-18859
Investigation of magnetic water treatment devices
N78-18987

CNR, INC., NEEDHAM, MASS.
Multipath over LOS channels study
[AD-A048175] N78-18271

COAST GUARD, WASHINGTON, D.C.
Preliminary tests of inflatable liferafts for stability in high winds
[AD-A048722] N78-18023

COLORADO STATE UNIV., FORT COLLINS.
Application of minicomputers to studies in electroanalytical chemistry
N78-18148
Ignition criteria for non-premixed stagnation point flow
N78-18352
Stochastic models of solar energy systems
N78-18514
Tropical cyclone research by data compositing
[AD-A048168] N78-18635
Industrial ion source technology
[NASA-CR-135353] N78-18883

COLORADO UNIV., BOULDER.
A simulation model for an enplaning-passenger-vehicle curbside at high-volume airports
N78-18020
Computer simulation of InP transferred-electron devices designed for Ka-band operation
N78-18303
Exciter force apportioning for modal vibration testing using incomplete excitation
N78-18456
Interplay between algebra and topology: Groupoids in a variety
N78-18866
The interaction of a strong stellar wind with the interstellar medium
N78-19015

COLUMBIA UNIV., NEW YORK.
A review of theories for the fluid dynamic effects of roughness on laminar lubricating films
[AD-A048333] N78-18217
Survey of linear MHD stability in Tokamak configurations
[COO-2456-46] N78-18942

COMMISSARIAT A L'ENERGIE ATOMIQUE, GRENOBLE [FRANCE].
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[LETI/EPA/CRM-1248] N78-18405

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Space shuttle, 1978
[GPO-99-072] N78-18106

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[AD-A048553] N78-18093

COMPUTER SCIENCES CORP., SAN DIEGO, CALIF.
Simulation code for underwater television systems [SCOUTS]
[AD-A048769] N78-18283

CONGRESSIONAL BUDGET OFFICE, WASHINGTON, D. C.
President Carter's automobile related energy conservation proposals
N78-18542

CONNECTICUT UNIV., STORRS.
Chemical degradation and stress-cracking of drawn poly[ethylene terephthalate] fibers
N78-18209
Non-linearly induced residual currents in tidally dominated estuaries
N78-18660

CORNELL UNIV., ITHACA, N. Y.
High pressure hot pressing of tantalum carbide to attain a two hundred angstrom grain size
N78-18179
Small-signal characteristics of gallium arsenide Schottky-Read IMPATT diodes
N78-18300
Network reliability analysis: Algorithms and complexity
N78-18863
Optimal data storage and organization in computerized information processing systems subject to failures
N78-18974

CORNELL UNIV., NEW YORK.
Relaxation of the bending mode of carbon dioxide by vibration to rotation and vibration to vibration energy transfer
N78-18951
A practical Hadamard spectrometer for astronomical application
N78-19007
The 16 to 40 micron spectra of Jupiter and Venus
N78-19008

COUNCIL OF STATE GOVERNMENTS, WASHINGTON, D.C.
Diffuse source pollution: Policy considerations for the states
[PB-274493/6] N78-18592

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[ESA-CR[P]-1009] N78-18979

CUMMINS ENGINE CO., INC., COLUMBUS, IND.
Trucking and fuel economy
N78-18538

D

DALLAS DEPT. OF WATER UTILITIES, TEX.
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[PB-274874/7] N78-18992

DAVID SARNOFF RESEARCH CENTER, PRINCETON, N.J.
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[AD-A048466] N78-18961

DECISION ANALYSIS AND RESEARCH INST., AUSTIN, TEX.
An evaluation of mathematical programming and minicomputers
[AD-A048299] N78-18805
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[AD-A048297] N78-18814

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[AD-A047965] N78-18966
Selecting analytic approaches for decision situations Volume 2. Case studies
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[AD-A048449] N78-18327

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[DLR-FB-77-40] N78-18436
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[DLR-IB-151-77/11] N78-18058
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[DLR-IB-152-77/10] N78-18254
Progress in structural bonding through effective bondline stress analysis
[DLR-IB-152-77/18] N78-18468

DEUTSCHE FORSCHUNGS- UND VERSUCHSANSTALT FUER LUFT- UND RAUMFAHRT, COLOGNE [WEST GERMANY].
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[DLR-FB-77-35] N78-18016
Investigation of the jet wake discharge flow of a heavily loaded centrifugal compressor impeller
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Fundamental investigations on effusion cooling of turbine blades
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[DLR-IB-456/76-6] N78-18107
SEAP - configuration and cost analysis
[DLR-IB-456-77/2] N78-18108
SEAP: A Spacelab experiments propulsive platform for the transport of Spacelab payloads. First study results
[DLR-IB-456-76/1] N78-18109
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[DLR-IB-76-3] N78-18110
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[DLR-IB-456-75/8] N78-18115
Rocket gas generators - terrestrial use of space technology
[DLR-IB-456-76/9] N78-18121
Lithergol dual propulsion for cruise missiles
[DLR-IB-76-7] N78-18122
USAP - a universal standardized propulsion platform for the transport of Spacelab payloads
[DLR-IB-456/75-9] N78-18123

Use of fluid injection to regulate the combustion chamber pressure for unstably burning solid propellant combustion
[DLR-IB-456-77/4] N78-18124
Program listing of an analytic mass model for chemical rocket stages
[DLR-IB-456-76/2] N78-18125
Hybrid propulsive systems: Technology and application
[DLR-IB-456-76/11] N78-18126
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Supporting investigations during testing of the WDL-1 airship in Ghana and Upper Volta
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A location and navigation method with traveling isophases
[DLR-IB-551-77/4] N78-18035
Optimal level controls of high performance aircraft
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Orbit determination and orbit prediction from measured data using the ELKORR program
[DLR-IB-552-76/10] N78-18094
The geometrical theory of diffraction - a method for the solution of electromagnetic boundary value problems of complicated structures in the high frequency case
N78-18290
The integral equation method - a computational method for diffracted and scattered fields of complicated structures
N78-18291
The effects of multipath reception on monopulse systems
[DLR-IB-551-77/7] N78-18292
Experiences with the ASSESS 2 lidar experiment
[DLR-IB-553-77/6] N78-18296
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The GEOS-20 m Cable Boom Mechanism
N78-19040

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Palefac
[AD-A048331] N78-18065
Nondestructible MESG program
[AD-A048191] N78-18397

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N78-18698
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N78-18839

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N78-18242

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N78-18553

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[PB-274865/5] N78-18594
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[PB-275053/7] N78-18582
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[ESA-TT-421] N78-18017
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[ESA-TT-434] N78-18081
Index of ELDO publications
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N78-18444
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N78-18548
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N78-18539

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N78-18544

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N78-18130
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N78-18206
Mechanisms and kinetics of binary alkali silicate glass corrosion
N78-18207
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N78-18302
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N78-18349
Atomic fluorescence flame spectrometry with a continuous wave dye laser
N78-18409
Simulation of transmission electron micrographs for small dislocation loops
N78-18904
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N78-18925
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N78-18653
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N78-18654
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N78-18543
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N78-18550
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N78-18552
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Saline-water intrusion in the Fernandina Beach area, Nassau County, Florida
[PB-274015/7] N78-18504
GEORGIA INST. OF TECH., ATLANTA.
Statistical estimation theory applied to synchronous generator modeling
N78-18306
Finite deformation, elastic-plastic, finite element analysis of planar cracks
N78-18447
Cost benefit analysis of the transfer of NASA remote sensing technology to the state of Georgia
[E78-10076] N78-18485
RF dielectric properties measurement system: Human and animal data
[PB-274776/4] N78-18711
GRUMMAN AEROSPACE CORP., BETHPAGE, N.Y.
Flight qualification of titanium F-14A airframe components manufactured by Hot Isostatic Pressing [HIP]
[AD-A048485] N78-18055
Fourier transform infrared spectroscopy: Demonstration of measurement capabilities in the laboratory and the field
[RM-648] N78-18157
CAVE3: A general transient heat transfer computer code utilizing eigenvectors and eigenvalues
[NASA-CR-145290] N78-18359
Partial differential rate equations for a bilevel absorber
[AD-A048601] N78-18854

H

HARRIS CORP., MELBOURNE, FLA.
Wideband holographic digital recording and reproduction
[AD-A048464] N78-18401
HARRY DIAMOND LABS., ADELPHI, MD.
Processing EMP-related flash X-ray test data with the TRANS2 computer program
[AD-A048159] N78-18276
Measurement of the impulse response of communication antennas
[AD-A048070] N78-18288
Cost and reliability aspects of large CMOS integrated circuits for fuzing applications
[AD-A048276] N78-18329
HAWKER SIDDELEY DYNAMICS LTD., STEVENAGE [ENGLAND].
Design and development of a solar array drive
N78-19046
HOLOSONICS, INC., RICHLAND, WASH.
A feasibility study for the development of a nuclear moisture density measurement system for marine use
[AD-A048665] N78-18663
HOUSTON UNIV., TEX.
Graph-dense linear transformations in Hilbert space
N78-18868
Quasi-Newton Methods
[NASA-CR-151637] N78-18871
Formal and computational studies of molecular collision dynamics
N78-18880
HUGHES AIRCRAFT CO., CULVER CITY, CALIF.
Synthetic aperture radar image processing techniques development and evaluation
[AD-A048193] N78-18269
Programmable in-raster symbol generator
[AD-A048596] N78-18333
Reliability evaluation of program.mable read-only memories [PROMs], part 2
[AD-A048231] N78-18800
Magnetometer deployment mechanism for Pioneer Venus
N78-19029
Torque-while-turnaround scan mirror assembly
N78-19037
HUGHES AIRCRAFT CO., TORRANCE, CALIF.
Model 8726H traveling wave tube
[AD-A048222] N78-18316
HUGHES HELICOPTERS, CULVER CITY, CALIF.
Liquid crystal airborne display
[AD-A048198] N78-18062
HUGHES RESEARCH LABS., MALIBU, CALIF.
Solid phase epitaxial growth
[AD-A048261] N78-18955
HUMAN ENGINEERING LABS., ABERDEEN PROVING GROUND, MD.
Human Engineering Laboratory Identification Friend or Foe test [HELIFF]
[AD-A048784] N78-18768

I

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[NASA-CR-150524] N78-18523
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[NASA-CR-150533] N78-18524
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[NASA-CR-150522] N78-18527
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[AD-A048483] N78-18328
IIT RESEARCH INST., ANNAPOLIS, MD.
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[AD-A048589] N78-18032
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[AD-A048659] N78-18140
ILLINOIS UNIV., URBANA.
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N78-18248
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[AD-A047963] N78-18185
Hydrogen embrittlement of niobium 3: High temperature behavior
[AD-A047957] N78-18187
Research on martensitic transformations in iron alloys
[AD-A047940] N78-18189
Full-field determination of the first derivative of normal surface displacement of thin plates using speckle photographic interferometry
N78-18446
Stress and vibration analysis of orthotropic shells of revolution
N78-18449
Estimating fatigue crack initiation and propagation lives in notched plates under variable loading histories
N78-18451
Nonlinear dynamic analysis of flat plate layered bodies accounting for large transverse deflections
N78-18452
WALSHSTORE: The application of burst processing to fail-soft storage systems using Walsh transforms
[AD-A047889] N78-18774
Phase transitions and critical phenomena: Universality and global multicritical phase diagrams from position-space renormalization-group studies
N78-18945
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N78-18385
Prediction of separation using boundary layer theory
N78-18386
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N78-18150
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N78-18600
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N78-18697
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[PB-274029/8] N78-18584
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N78-18049
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N78-18050
INFORMATICS INFORMATION SYSTEMS CO., LINTHICUM HEIGHTS, MD.
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[NASA-TM-79326] N78-18975
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[BMVG-FBWT-77-13] N78-18899
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[AD-A048610] N78-18332
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[AD-A048609] N78-18861

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[AD-A048611] N78-18264
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[PB-274113/0] N78-18565
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[IIASA-RM-77-21] N78-18810
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[IRI-190-77-01] N78-18709
IONICS, INC., WATERTOWN, MASS.
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[NASA-CR-135316] N78-18515
IOWA STATE UNIV. OF SCIENCE AND TECHNOLOGY, AMES.
Electromigration of hydrogen and deuterium in vanadium, niobium and tantalum
N78-18177
Effect of drawing atmosphere on surface characteristics of glass fibers
N78-18208
Regression estimation for multivariate normal distributions
N78-18830
Comparison between phase shift derived and exactly calculated nucleon-nucleon interaction matrix elements
N78-18893
IOWA UNIV., IOWA CITY.
Substructuring methods for design sensitivity analysis and structural optimization
N78-18230
Effects of vertical distortion on thermalhydraulic modeling of surface discharges
N78-18479
Influence of central venous pressure upon sinus node responses to arterial baroreflex stimulation in man
[NASA-CR-155783] N78-18678
Influence of low and high pressure baroreceptors on plasma renin activity in humans
[NASA-CR-155307] N78-18701
IRT CORP., SAN DIEGO, CALIF.
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[AD-A048264] N78-18317
ISTITUTO SUPERIORE DI SANITA, ROME (ITALY).
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[ISS-T-76/6] N78-18344
The Monte Carlo simulation of the Ladon photon beam facility
[ISS-P-76/10] N78-18425
Technical and scientific aspects of sanitary and safety problems in nuclear energy production
[ISS-P-76/9] N78-18706
NEXT - instruction manual
[ISS-T-77/1] N78-18889
The structure of complexes of mono- and polynucleotides with metal ions of the first transition group. Part 1: Crystallographic studies
[ISS-R-76/7-PT-1] N78-18891
The structure of complexes of mono- and polynucleotides with metal ions of the first transition group. Part 2: Nuclear magnetic resonance studies
[ISS-R-76/8-PT-2] N78-18892

J

JET PROPULSION LAB., CALIF. INST. OF TECH., PASADENA.
Ion Propulsion Module [IPM] technology readiness assessment: 1985 Halley's Comet rendezvous mission
[NASA-CR-155308] N78-18120
Clutter free synthetic aperture radar correlator
[NASA-CASE-NPO-14035-1] N78-18266
Interferometer mirror tilt correcting system
[NASA-CASE-NPO-13687-1] N78-18391
Over-under double-pass interferometer
[NASA-CASE-NPO-13999-1] N78-18395
A system and method for obtaining wide screen schlieren photographs
[NASA-CASE-NPO-14174-1] N78-18396
Independent gain and bandwidth control of a traveling wave maser
[NASA-CASE-NPO-13801-1] N78-18410
Cluster compression algorithm: A joint clustering/data compression concept
[NASA-CR-155780] N78-18495
Phase 1 of the automated array assembly task of the low cost silicon solar array project
[NASA-CR-155935] N78-18516
Hot forming of silicon sheet, silicon sheet growth development for the large area silicon sheet task of the low cost silicon solar array project
[NASA-CR-155934] N78-18517
Synthesis of silane and silicon in a non-equilibrium plasma jet
[NASA-CR-155933] N78-18518
Energy requirement for the production of silicon solar arrays
[NASA-CR-155932] N78-18519
Analysis of requirements for accelerating the development of geothermal energy resources in California
[NASA-CR-155782] N78-18528
Computer program for design and performance analysis of navigation-aid power systems. Program documentation. Volume 1: Software requirements document
[AD-A047925] N78-18558
Synthesis and biological screening of novel hybrid fluorocarbon hydrocarbon compounds for use as artificial blood substitutes
[NASA-CR-155781] N78-18702
An analysis of the technical status of high level radioactive waste and spent fuel management systems
[NASA-CR-155313] N78-18897
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N78-19041
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Space Biology and Aerospace Medicine, no. 5, 1977
[JPRS-70135] N78-18679
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N78-18680
Aviation medicine on the sixtieth anniversary of the great October revolution
N78-18681
Biomechanical criteria of artificial gravity
N78-18682
Change in gravitation level as a stress factor
N78-18683
Main results of medical research conducted during the flight of two crews on the Salyut-5 orbital station
N78-18684
Distinctions of fluid and electrolyte metabolism and renal function in crew members of the first Salyut-4 expedition
N78-18685
Technique for selective catheterization of the heart and great vessels used in biomedical studies of healthy individuals
N78-18686
Parameters of acid-base equilibrium and enzymatic activity of blood in man during brief antiorthostatic hypokinesia
N78-18687
Main objectives and results of the radiobiological experiment conducted on the Kosmos-690 biosatellite
N78-18688
Lactate dehydrogenase isozymes of rat skeletal muscles following a space flight and with hypokinesia
N78-18689
Morphological manifestations of functional changes in the hypothalamo-hypophyseal neurosecretory system and rat kidneys under the influence of space flight factors
N78-18690
Effect of head orientation in the gravity field on severity of caloric nystagmus
N78-18691
A study of the pulsed method of laundering
N78-18692
Significance of the percussion symptom in detection of peptic ulcers in flight personnel
N78-18693
Autogenic training used for self-regulation of cardiovascular function and prevention of neurocirculatory dystonia in pilot candidates
N78-18694
Investigation of space perception by the crew of the experimental Soyuz-Apollo mission
N78-18695
Effects of high concentrations of carbon dioxide on function of the human acoustic analyzer
N78-18696
Space Biology and Aerospace Medicine, no. 3, 1977
[JPRS-69380] N78-18715
Psychopharmacology in aviation and astronautics
N78-18716
Experimental and general theoretical research
N78-18717
Distinctive features of regional circulation and vasomotor regulation following a two-month space flight
N78-18718
Studies of circulation during LBNP test aboard Salyut-4 orbital stations
N78-18719
Dynamics of orthostatic stability of cosmonauts following 2 to 63 day missions
N78-18720
Some psychoneurological requirements in assessing inflight functional state of cosmonauts
N78-18721
Histochemical study of digestive organs of rats following flight on Kosmos-605
N78-18722
Mucopolysaccharides and collagen of tissues in hypokinetic rats
N78-18723
Cardiovascular reactions to orthostatic tests and human resistance to vestibular stimuli
N78-18724
Dynamic control of parameters of spacecraft atmosphere
N78-18725
Mechanics of speech-related respiration while performing static physical exercise
N78-18726
Electrolyte content of blood and potassium ion transport in erythrocytes of animals exposed to a steady magnetic field
N78-18727
Hemopoiesis in dogs exposed to lethal doses of protons with shielded bone marrow
N78-18728
Investigation of concomitant microflora in prolonged substrate-free cultivation of beet plants
N78-18729
Physiology of antiorthostatism
N78-18730
Heterophilic antibodies and complement activity of rat blood serum after flight in Kosmos-605 satellite
N78-18731
Measurement of radiation doses in the Soyuz-16 spacecraft
N78-18732
Blood clotting function during 12-day immersion in water, and the preventive role of revolving on a centrifuge
N78-18733
Defense reactions of the organism while breathing high concentrations of carbon dioxide
N78-18734
Effect of gamma radiation on intensity of ammonia excretion in albino rats
N78-18735
Otolith system function in cosmonauts following space missions
N78-18736
Sudden loss of consciousness in pilots with low intraocular pressure during exposure to G forces
N78-18737
Space Biology and Aerospace Medicine, no. 4, 1977
[JPRS-69964] N78-18738
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N78-18739
Dynamics of cyclic and acyclic locomotion of the Soyuz-18 crew after a 63-day space mission
N78-18740
Medical support of the immediate postflight period following long space missions
N78-18741
DNA status in rat liver and spleen following flight on Kosmos-605 satellite
N78-18742
Effect of prolonged space flight on protein biosynthesis in various rat organs and tissues
N78-18743
Cytochemical studies of proteins and RNA in individual spinal cord motoneurons and spinal ganglia neurons of rats following a space flight
N78-18744
Vestibulotonic reflexes in muscles of the rat hind limb following a flight on Kosmos-605
N78-18745
Clinical and biochemical aspects of human adaptation to central Antarctica as applied to problems of space biology and medicine
N78-18746
Effect of prolonged hypokinesia on the course of acute aseptic inflammation
N78-18747
Effects of chronic exposure to carbon monoxide on biochemistry of human blood
N78-18748
Effect of superhigh intensity constant magnetic fields on morphological composition of peripheral blood
N78-18749
Organism reactions to hypoxia following exposure to gamma radiation
N78-18750
Cataractogenic effect of 25 and 50 MeV protons
N78-18751
Acute leukocytic reactions to impact accelerations
N78-18752
Investigation of personality traits of pilots and navigators
N78-18753
Tetrapolar rheography used to evaluate the circulatory system
N78-18754
Carbohydrate and lipid content of rat liver tissue following a 22-day space flight
N78-18755

Changes in circulating blood volume and filling of the brain and internal organs of rats following acute and chronic hypoxia
N78-18756

The hematic system in the set of symptoms of autonomic disorders in monkeys on the low gravitation stand
N78-18757

Relationship between onset of altitude-decompression disorders in man and barometric pressure level during intensive physical exercise
N78-18758

Prevention of hypertensive states in ship crews out at sea
N78-18759

K

KANSAS UNIV., LAWRENCE.
Deflected heated water jets, theory and experiments
N78-18354

On the feasibility of monitoring soil moisture using active microwave remote sensing: An experimental evaluation
N78-18477

Cropland inventories using an orbital imaging radar
N78-18478

Quadrature approximation of Bayesian recursive computations and the implementation of nonlinear estimators
N78-18794

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N78-18867

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[NASA-CR-145304] N78-17993

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[PB-274406/8] N78-18560

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[LCR-450/258] N78-18343

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N78-19038

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[AD-A048300] N78-18113

Finite element capabilities in MIT Lincoln Laboratory version of STRUDL
[AD-A048605] N78-18466

Design for high accuracy critical-angle sun transit sensor
[AD-A048287] N78-18911

The mount performance of the second GEODSS telescope
[AD-A048745] N78-18912

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[AD-A048662] N78-18416

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[E78-10075] N78-18484

A system analysis of the 13.3 GHz
[NASA-CR-151627] N78-18496

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[NASA-CR-151616] N78-18624

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[NASA-CR-150563] N78-18520

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N78-18211

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N78-18250

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[NASA-CR-135342] N78-18251

The STAGS computer code
[NASA-CR-2950] N78-18458

Hybrid structures of revolution
[AD-A047982] N78-18461

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An application of interactive computer graphics technology to the design of dispersal mechanisms
N78-19032

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Image restorations constrained by a multiply exposed picture
[LA-UR-77-1790] N78-18404

Development of cryogenic targets for laser fusion
[LA-UR-77-1523] N78-18936

LOUISIANA STATE UNIV. AND A&M COLL., BATON ROUGE.
Structure elucidation by nuclear magnetic resonance spectroscopy
N78-18145

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N78-18347

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N78-18819

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[LYCEN-7719] N78-18167

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[LYCEN-7705] N78-18342

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N78-18060

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N78-19030

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N78-19036

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N78-19044

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The photochemistry of amides and phthalimides
N78-18149

High Q selective filters using mechanical resonance of silicon beams
N78-18304

Synthesis of linear passive time-variable transmission matrices
N78-18305

On the prediction of mass flow rates of propane
N78-18350

Unconfined thermal discharges near free surfaces
N78-18351

The application of invariant imbedding to problems in elastic stability
N78-18453

Size and composition of atmospheric particles in rural areas near Washington, D. C.
N78-18570

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N78-18571

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N78-18835

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[AD-A048072] N78-18841

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N78-18922

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[AD-A048289] N78-18197

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[AD-A048746] N78-18218

Improved quantum receivers for optical communication
[AD-A048688] N78-18280

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[PB-274539/6] N78-18434

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[PB-274540/4] N78-18435

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N78-18534

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N78-18547

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[AD-A048765] N78-18782

Simulation of packet communication architecture
[AD-A048290] N78-18783

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[NASA-CR-2916] N78-18822

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[PB-275353/1] N78-18986

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N78-18210

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N78-18952

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N78-19010

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[AD-A048268] N78-18858

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[AD-A048598] N78-18421

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[NASA-CR-135328] N78-18460

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[BMVG-FBWT-77-15] N78-18013

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[AD-A048587] N78-18162

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N78-18450

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N78-18601

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N78-18831

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N78-18301

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N78-18820

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N78-18832

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[AD-A048764] N78-18420
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[IPPJ-313] N78-18929
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[IPPJ-314] N78-18930
A perturbation expansion for the nonlinear Schrodinger equation with application to the influence of nonlinear Landau damping
[IPPJ-315] N78-18931
Interconnected linear theta pinches
[IPPJ-316] N78-18932
Optical escape factors for Doppler profiles in spherical, cylindrical and plane parallel geometries
[IPPJ-317] N78-18933
A scaling law for high density Tokamaks and its application to JIPP t-2 device
[IPPJ-318] N78-18934
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[IPPJ-319] N78-18935
NAIROBI UNIV. [KENYA].
Existence of solutions for the prestressed non-linear orthotropic heated plates
N78-18247
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[PB-274965/3] N78-18713
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[NASA-TM-75058] N78-18097
Comparative characteristics of electron energy spectrum in PIG and arc type discharge plasmas
[NASA-TM-75255] N78-18307
Coupling of electromagnetic waves and space charge waves in type O traveling wave tubes
[NASA-TM-75249] N78-18309
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[NASA-TM-75256] N78-18310
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[NASA-SP-5104] N78-18312
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[NASA-TM-75148] N78-18357
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Volume discharge in a gas, excited by an electron beam under conditions of nonuniform ionization
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[NASA-TM-75178] N78-18953
Accessing numeric data via flags and tags: A final report on a real world experiment
[NASA-TM-79326] N78-18975
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[NASA-TM-79361] N78-18976
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[NASA-TM-75078] N78-18989
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[NASA-TM-75083] N78-19012
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[NASA-TM-78459] N78-18043
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[NASA-CASE-ARC-10903-1] N78-18083
Toxicity of pyrolysis gases from synthetic polymers
[NASA-TM-78458] N78-18127
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N78-18380
Introduction to unsteady aspects of separation in subsonic and transonic flow
N78-18381
Some unsteady separation problems for slender bodies
N78-18383
Prediction of unsteady separated flows on oscillating airfoils
N78-18387
Status and future prospects of using numerical methods to study complex flows at high Reynolds numbers
N78-18388
Air transportation energy efficiency
N78-18540
Spacesuit mobility joints
[NASA-CASE-ARC-11058-2] N78-18763
The search for extraterrestrial intelligence [SETI]
[NASA-SP-419] N78-18771
Exchange and relaxation effects in low-energy radiationless transitions
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N78-19042
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[NASA-TM-72851] N78-18075
Analytical study of ride smoothing benefits of control system configurations optimized for pilot handling qualities
[NASA-TP-1148] N78-18076
Window comparator
[NASA-CASE-FRC-10090-1] N78-18308
Attaching of strain gages to substrates
[NASA-CASE-FRC-10093-1] N78-18393
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. GODDARD SPACE FLIGHT CENTER, GREENBELT, MD.
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[NASA-CASE-GSC-12171-1] N78-18313
Sensors Workshop summary report
[NASA-TM-74978] N78-18498
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The MJS-77 magnetometer actuator
N78-19034
An active nutation damper for spacecraft
N78-19039
Focus drive mechanism for the IUE scientific instrument
N78-19045
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[NASA-TP-1155] N78-18364
Method and apparatus for eliminating luminol interference material
[NASA-CASE-MSC-16260-1] N78-18674
Emergency space-suit helmet
[NASA-CASE-MSC-10954-1] N78-18761
Apollo 14 coarse fines [4-10 mm] sample location and classification
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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LANGLEY RESEARCH CENTER, LANGLEY STATION, VA.
Theoretical evaluation of high speed aerodynamics for arrow wing configurations
[NASA-TM-78659] N78-17992
A flight evaluation of a trailing anemometer for low-speed calibrations of airspeed systems on research aircraft
[NASA-TP-1135] N78-18044
Fuselage structure using advanced technology metal matrix fiber reinforced composites
[NASA-CASE-LAR-11688-1] N78-18045
Laser velocimeter survey about a NACA 0012 wing at low angles of attack
[NASA-TM-74040] N78-18084
Design and performance evaluation of slotted walls for two-dimensional wind tunnels
[NASA-TM-78648] N78-18085
An introduction to shuttle/LDEF retrieval operations: The R-bar approach option
[NASA-TM-78668] N78-18105
Optimization of the design parameters for a wide-band radiometric system
[NASA-TM-78662] N78-18117
Third Conference on Fibrous Composites in Flight Vehicle Design, part 1
[NASA-TM-X-3377-PT-1] N78-18133
Third Conference on Fibrous Composites in Flight Vehicle Design, part 2
[NASA-TM-X-3377-PT-2] N78-18134
Tensile stress-strain behavior of boron/aluminum laminates
[NASA-TP-1117] N78-18135
Evaluation of a laboratory test model annular momentum control device
[NASA-TP-1142] N78-18252
Design of microstrip disk antenna arrays
[NASA-TM-78631] N78-18263
Turbulent boundary layers over nonstationary plane boundaries
[NASA-TM-74091] N78-18358
Forebody and afterbody solutions of the Navier-Stokes equations for supersonic flow over blunt bodies in a generalized orthogonal coordinate system
[NASA-TP-1075] N78-18362
Inviscid, nonadiabatic flow fields over blunt, sonic corner bodies for outer planet entry conditions by a method of integral relations
[NASA-TP-1133] N78-18363
Solar cell angular position transducer
[NASA-CASE-LAR-11999-1] N78-18394

Development and application of an optimization procedure for flutter suppression using the aerodynamic energy concept
[NASA-TP-1137] N78-18459
Trace elemental characteristics of aerosols emitted from municipal incinerators
[NASA-TM-78630] N78-18572
Drop foot corrective device
[NASA-CASE-LAR-12259-1] N78-18762
A computer program for analyzing unresolved Mossbauer hyperfine spectra
[NASA-TM-78633] N78-18796
Eigenvalue/eigenvector assignment using output feedback
[NASA-TP-1118] N78-18823
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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LEWIS RESEARCH CENTER, CLEVELAND, OHIO.
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[NASA-TP-1132] N78-17998
Integrated gas turbine engine-nacelle
[NASA-CASE-LEW-12389-2] N78-18066
Variable mixer propulsion cycle
[NASA-CASE-LEW-12917-1] N78-18067
Tantalum modified ferritic iron base alloys
[NASA-CASE-LEW-12095-1] N78-18182
Directionally solidified eutectic gamma-gamma nickel-base superalloys
[NASA-CASE-LEW-12905-1] N78-18183
Thermal barrier coating system
[NASA-CASE-LEW-12554-1] N78-18355
Statistical model for asperity-contact time fraction in elastohydrodynamic lubrication
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[NASA-CP-2026] N78-18088
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Guidelines for the selection and application of tantalum electrolytic capacitors in highly reliable equipment
[NASA-TM-X-64755-REV-A] N78-18311
Semiconductor projectile impact detector
[NASA-CASE-MFS-23008-1] N78-18390
Analysis of data systems requirements for global crop production forecasting in the 1985 time frame
[NASA-TP-1164] N78-18497

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A system for delivering SiCl4 to a chemical reactor
[NASA-CASE-NPO-14383-1] N78-18253
Clutter free synthetic aperture radar correlator
[NASA-CASE-NPO-14035-1] N78-18266
Interferometer mirror tilt correcting system
[NASA-CASE-NPO-13687-1] N78-18391
Over-under double-pass interferometer
[NASA-CASE-NPO-13999-1] N78-18395
A system and method for obtaining wide screen schlieren photographs
[NASA-CASE-NPO-14174-1] N78-18396
Independent gain and bandwidth control of a traveling wave maser
[NASA-CASE-NPO-13801-1] N78-18410

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[NASA-TM-69366] N78-18265

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[NLR-TR-75115-U] N78-18009
PHAROS, processor for harmonic analysis of the response of oscillating surfaces
[NLR-MP-77012-U] N78-18019
Fatigue design of fighters; guidelines for obtaining and maintaining adequate fatigue performance of tactical aircraft: General survey N78-18047
Fatigue load monitoring N78-18052
Flight-path reconstruction of symmetric nonsteady flights
[NLR-TR-76133-U] N78-18056
Flight test of stick force stability in attitude-stabilized aircraft
[NLR-MP-77015-U] N78-18080
Determination of antenna radiation patterns, radar cross sections and jam-to-signal ratios by flight tests
[NLR-MP-76023-U] N78-18289
A simple finite difference technique for the computation of three-dimensional incompressible laminar boundary layers. Part 1: Description of the method
[NLR-TR-76086-U] N78-18371
The determination of crack propagation curves with the aid of electron microscopy
[NLR-TR-75165-U] N78-18475

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Conservation districts and 208 water quality management: Non-point source identification and assessment, selection of best management practices, management agencies, regulatory programs
[PB-274411/8] N78-19001

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Studies of the flash fire potential of aircraft cabin interior materials
[AD-A048475] N78-18158
Test and evaluation of the Moving Target Detector [MTD] radar
[AD-A04788] N78-18260

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The thermodynamic properties of slush hydrogen and oxygen
[NASA-CR-155743] N78-18168
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[PB-274938/0] N78-18287
The characteristics of broadband, isotropic electrical field and magnetic field probes
[PB-274457/1] N78-18339
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[PB-274456/3] N78-18402
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[PB-274218/7] N78-18714

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[PB-274643/6] N78-18256
A computer code for the simulation of turbulent swirling flow through closed-conduit flow meters
[PB-274650/1] N78-18370
State solar energy legislation of 1976: A review of statutes relating to buildings
[PB-273899/5] N78-18567
Estimating the energy conservation potential of ventilation control through weather data analysis
[PB-273949/8] N78-18655
Four versatile MIDAS compatible modules
[PB-274433/0] N78-18785
FORTRAN program to determine length of gage blocks using single wavelength interferometry
[PB-274895/2] N78-18811

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Systems for the determination of polar motion
[PB-274698/0] N78-18617

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[PB-275096/6] N78-18614
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[PB-275095/8] N78-18615
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[PB-274824/2] N78-19024

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[PB-274750/9] N78-18591

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[NASA-TP-1017] N78-18630

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[PB-275212/9] N78-18619
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[PB-275346/5] N78-18656

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[NASA-CR-141435] N78-18661

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Methods for the calculation of the value of the logarithm of the activity coefficient of a component at infinite dilution from binary vapour-liquid data
[NPL-CHEM-74] N78-18165
The pVT properties of acetic acid
[NPL-CHEM-76] N78-18166
NPL 7 creep damage in Ni-Cr base alloys
[NPL-DMA-246] N78-18202
Simulation of the 10-node data communication network operating with link speeds of 9.6 Kb/s
[NPL-COM-87] N78-18297
Notes on design of high efficiency beam dividers for two beam infra-red interferometers
[NPL-QU-41] N78-18406
Resistance ratio/temperature relationships for industrial platinum resistance thermometers of thick film construction
[NPL-QU-42] N78-18407
A digital frequency-offset lock system designed for use with stabilized lasers
[NPL-QU-40] N78-18424
The diagnostic facilities in ALGOL and FORTRAN compilers
[NPL-NAC-81] N78-18786
An introduction to network job control language
[NPL-COM-88] N78-18809
Problems in designing a high-speed linear data bus for a multimicroprocessor system
[NPL-COM-89] N78-18817
Polarized light: Definitions and nomenclature
[NPL-MOM-25] N78-18921
Activities of the Quantum Metrology Division
[NPL-QU-AR75] N78-18973
Augmentation of a text retrieval system with an intelligent graphics terminal
[NPL-COM-86] N78-18980

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Application of Doppler weather radar to turbulence measurements which affect aircraft
[AD-A048603] N78-18641

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A snow index using 200 mb warm advection
[PB-275184/0] N78-18657

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Accelerated laboratory corrosion test for materials and finishes used in naval aircraft
[AD-A048059] N78-18188
A personal cooling system for helicopter pilots
[AD-A047649] N78-18767

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Computer technique for calculations of potential distribution in multidielectric media
[AD-A048057] N78-18323
Cable strumming suppression
[AD-A047996] N78-18366

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Application of a root finding method for tropospheric ducting produced by trilinear refractivity profiles
[AD-A047916] N78-18267
Programmable Data Terminal Set [PDTS] UHF test with AN/WSC-3 radio. Operational capability of PDTS is demonstrated
[AD-A048295] N78-18281
Large-aperture optical modulator materials. Lead lanthanum zirconate titanate ceramic and lithium niobate crystal show promise as modulator materials for optical transmitters with up to 6-inch apertures
[AD-A048163] N78-18909

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Variability of oceanographic conditions at ocean weather stations in the north Atlantic and north Pacific Oceans
[AD-A048730] N78-18665

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Circulation control airfoil study
[AD-A048677] N78-18005
A comparison of integrated and conventional cockpit warning systems
[AD-A048670] N78-18022
Test and evaluation for an air-launched guided missile program
[AD-A048675] N78-18100

A study of the effect of velocity on corrosion of galvanic couples in seawater using a circling-foil apparatus
[AD-A048065] N78-18186
Investigation into the effect of dissimilar metal coupling, potential, and processing on the mode and distribution of galvanic corrosion attack on 5086 aluminum alloy in synthetic seawater
[AD-A048527] N78-18190
The effects of velocity on corrosion of galvanic couples in seawater
[AD-A048669] N78-18191
Aerodynamic stabilization of gaseous discharges
[AD-A048533] N78-18415
A comparative study of the coastal marine aerosol
[AD-A048673] N78-18576
The kinematics of breaking waves in the surf zone
[AD-A048723] N78-18666
Total contractor logistics support: A new concept in naval aviation
[AD-A048674] N78-18971

NAVAL RESEARCH LAB., WASHINGTON, D. C.
Reflex tetrode with unidirectional ion flow
[AD-A048751] N78-18336
Transient free-surface hydrodynamics
[AD-A048749] N78-18368
The 1976 NRL air quality data
[AD-A048750] N78-18579
Morphological studies of rising equatorial spread F bubbles
[AD-A048752] N78-18612
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[AD-A048753] N78-18887

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Drag, flow transition, and laminar separation on nine bodies of revolution having different forebody shapes
[AD-A048274] N78-18001
Parametric transonic evaluation of type A VSTOL nacelle drag
[AD-A048110] N78-18002
Fabrication of pressure tank using HY-100 steel
[AD-A048767] N78-18433

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High strength aluminum casting technology: Squeeze casting of 7075 alloy
[AD-A048657] N78-18192

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DOT behavior of waxed mixtures pf RDX, HMX, and tetryl
[AD-A047968L] N78-18225
The density, electrical resistivity and Hall coefficient of Li-B alloys
[AD-A048064] N78-18325

NAVAL UNDERWATER SYSTEMS CENTER, NEW LONDON, CONN.
Sea nymph pilot LCC model development
[AD-A048109] N78-18278
Numerical results for modified image theory quasi-static range subsurface-to-subsurface and subsurface-to-air propagation equations
[AD-A048345] N78-18286
NUSC technical publication guidelines
[AD-A048066] N78-18978

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Temperature dependence of the dielectric constant of quartz polymide
[AD-A047850] N78-18136

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[NASA-CR-155774] N78-18884

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[AD-A048199] N78-18365

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[PB-275317/6] N78-18670

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Long range transportation planning under energy constraints: A critical review of current capability
N78-18532

NORDEN, NORWALK, CONN.
Standard electronic module radar cost analysis
[AD-A048207] N78-18319

NORTH CAROLINA STATE UNIV., RALEIGH.
Theoretical studies of cyclic straining in polycrystalline metal plasticity
N78-18454
A computer analysis of heterojunction and graded bandgap solar cells
N78-18512
Solar energy storage subsystem utilizing latent heat of phase change
N78-18513
Thermodynamic properties of U[C,N] solid solutions and derived relationships among Thermodynamic excess properties
N78-18963

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N78-19006

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[AD-A048229] N78-18414
Optically induced hot electron effects in semiconductors
[AD-A048194] N78-18956

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N78-18838

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[AD-A048204] N78-18029

NORTHWESTERN UNIV., EVANSTON, ILL.
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[AD-A047926] N78-18431
Optical dispersion and electrical transport studies of iron intercalated zirconium diselenide
N78-18906
A spectroscopic investigation of the Be binary system phi Persei
N78-19011

NOTRE DAME UNIV., IND.
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N78-18773

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OAK RIDGE NATIONAL LAB., TENN.
Design of superconducting toroidal magnet coils and testing facility in the USA
[CONF-770842-5] N78-18340
Data needs in transportation energy conservation research
N78-18554
Atomic reactions in very high temperature plasmas
[CONF-770721-1] N78-18937

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Presentation of the subject
N78-18376
Numerical solution of viscous-inviscid interaction problems in two-dimensional compressible flows based on the Navier-Stokes equations
N78-18378
Viscid-inviscid interaction methods for two-dimensional flows, including separation and shock waves
N78-18379

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[AD-A048067] N78-18277
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[PB-274458/9] N78-18299

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[PB-274440/7] N78-19002

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Theory of the galvanomagnetic properties of inhomogeneous metals: Application to copper
N78-18184
Pattern prediction of wire antennas on satellite structures
[AD-A048654] N78-18279

OHIO UNIV., ATHENS.
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N78-18151

OLD DOMINION UNIV., NORFOLK, VA.
Optimal control of a large space telescope using an annular momentum control device
N78-18428
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[PB-275247/5] N78-18671

OLSON LABS., INC., ANAHEIM, CALIF.
Effect of preconditioning on in-use vehicle testing and failure analysis of evaporative emission control systems
[PB-274902/6] N78-18580
Vehicle exhaust emission instruments evaluation
[PB-274547/9] N78-18597

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[AD-A048200] N78-18776

OREGON STATE UNIV., CORVALLIS.
Mixed layer observations during the NORPAX POLE experiment
[AD-A048581] N78-18664
A new computational method for constrained nonlinear programming
N78-18793
Hypothesis testing for the parameters of a covariance matrix having linear structure
N78-18829

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A distributed hierarchical computer system for laboratory automation
N78-18812

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N78-18243
A multi-purpose cryostat for freezing biological materials
[OUEL-1195/77] N78-18255
Studies of gas injection into a liquid stream
[OUEL-1216/77] N78-18373
Calculations of stresses in wall ironing
[OUEL-1187/77] N78-18469
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[OUEL-1199/77] N78-18470
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[OUEL-1206/77-VOL-1] N78-18471
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[OUEL-1209/77] N78-18472
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[OUEL-1210/77-VOL-2] N78-18473
Applications of quantum electronics. Part 1: The scanning optical microscope
[OUEL-1183/77-PT-1] N78-18917
Applications of quantum electronics. Part 2: The metal coating of optical fibres
[OUEL-1184/77-PT-2] N78-18918
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[OUEL-1185/77-PT-3] N78-18919
The scanning optical microscope
[OUEL-1220/77] N78-18920
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[OUEL-1189/77] N78-18993

P

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[AD-A048208] N78-18824

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N78-18221

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N78-18537

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[PB-275000/8] N78-18566

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[NASA-CR-155766] N78-17995
Investigation of the unsteady pressure distribution on the blades of an axial flow fan
[NASA-CR-15571] N78-18068
Use of LANDSAT-1 data for the detection and mapping of saline seeps in Montana
[E78-10074] N78-18483

PENNSYLVANIA UNIV., PHILADELPHIA.
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[NASA-CR-155934] N78-18517
Energy use in intercity freight transport and policy implications
N78-18536
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N78-18950

PLANETARY SCIENCE INST., TUCSON, ARIZ.
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[NASA-CR-155310] N78-19016
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N78-19027
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N78-18232
Equations of steady flow through slightly curved multifilament bundles
N78-18233
Theory of disclinations in elastic Cosserat media
N78-18234
Coupling of dissipative mechanisms of viscoplastic flow
N78-18238
Field equations for micropolar current and a heat conducting magnetically-saturated solid
N78-18239
Archives of Mechanics, volume 29, issue 5
N78-18240
Disclination kinematics
N78-18241
Preliminary experiment on acoustoelasticity for stress analysis
N78-18244
Plasticity of polycrystal
N78-18245
Forces in material Space
N78-18246
POLYTECHNIC INST. OF NEW YORK.
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[NASA-CR-155779] N78-17996
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[NASA-CR-135252] N78-18070
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PRINCETON UNIV., N. J.
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N78-18171
Investigation of the T sub LL [T sub g] relaxation in homopolymers and block copolymers of styrene by torsional braid analysis
[AD-A048455] N78-18219
Space-time evolution of nonlinear three-wave interactions
N78-18257
Collision studies of gaseous molecular lasers
[AD-A048010] N78-18413
Electron number density measurement by ruby laser interferometry in a CO2 laser-induced gas breakdown plasma
[CONF-770725-1] N78-18938
Boltzmann equation integration in thermionic converter conditions. Part 2: Terms in Boltzmann equation
[PPPL-1346-PT-2] N78-18939
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[PPPL-1352] N78-18940
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[PB-274207/0] N78-18990
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[PB-274180/9] N78-18997
PURDUE UNIV., LAFAYETTE, IND.
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N78-18144
Effects of pressure on ion exchange and ion pairing chromatography
N78-18154
Simultaneous kinetic and spectral analysis using a vidicon rapid-scanning stopped-flow spectrometer
N78-18155
Theory and methods for modelling acoustically long, unpartitioned cavity resonators for engine exhaust systems
N78-18427
The nonlinear response and stability of rotating shells
N78-18457
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[NASA-CR-151636] N78-18493
Multivariate analysis of atmospheric particulate composition and computer-controlled interference correction for ion-selective electrode measurements in a flowing stream
N78-18569
On rules based on sample medians for selection of the largest location parameter
[AD-A047948] N78-18860

R

R AND D ASSOCIATES, MARINA DEL REY, CALIF.
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[AD-A047986] N78-18272
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[AD-A048604] N78-18284
RADIATION RESEARCH ASSOCIATES, INC., FORT WORTH, TEX.
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[AD-A048614] N78-18913
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[AD-A047997] N78-18322
RAYTHEON CO., QUINCY, MASS.
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[AD-A048602] N78-18331
RAYTHEON CO., WALTHAM, MASS.
High durability missile domes
[AD-A048497] N78-18101
Manufacturing methods and technology engineering high-efficiency, high-power gallium arsenide read-type IMPATT diodes, volume 2
[AD-A048579] N78-18334
Manufacturing methods and technology engineering high-efficiency, high-power gallium arsenide read-type IMPATT diodes, volume 1
[AD-A048578] N78-18335
RCA GOVERNMENT AND COMMERCIAL SYSTEMS, BURLINGTON, MASS.
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[AD-A048484] N78-18914
RCA LABS., PRINCETON, N. J.
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[PB-274939/8] N78-18345
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[AD-A048481] N78-18613
RENSSELAER POLYTECHNIC INST., TROY, N. Y.
Focusing solar collector development
[PB-275042/0] N78-18561
RESEARCH INST. FOR ENVIRONMENTAL HYGIENE, TNO, DELFT [NETHERLANDS].
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[IG-PUBL-597] N78-18583
RESEARCH TRIANGLE INST., RESEARCH TRIANGLE PARK, N. C.
Continued investigation of potential application of Omega navigation to civil aviation
[NASA-CR-145307] N78-18028
ROCHESTER UNIV., N. Y.
High-speed fabrication of aspherical surfaces
N78-18900
Double optical resonance
N78-18901
The two level atom of quantum optics
N78-18902
ROCKETDYNE, CANOGA PARK, CALIF.
Tripropellant engine study
[NASA-CR-150562] N78-18119
ROCKWELL INTERNATIONAL CORP., ANAHEIM, CALIF.
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[AD-A048000] N78-18030
ROCKWELL INTERNATIONAL CORP., RICHARDSON, TEX.
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[AD-A047903] N78-18315
ROCKWELL INTERNATIONAL CORP., THOUSAND OAKS, CALIF.
A computational model for three-dimensional incompressible small cross flow wall jets
[AD-A048450] N78-18008
Impact damage in brittle materials in the plastic response regime
[AD-A048266] N78-18430
Lunar sample analysis
[NASA-CR-151618] N78-19021
ROME AIR DEVELOPMENT CENTER, GRIFFISS AFB, N.Y.
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[AD-A048037] N78-18557
ROYAL AIRCRAFT ESTABLISHMENT, BEDFORD [ENGLAND].
Prediction of the severity of buffeting
N78-18382
ROYAL AIRCRAFT ESTABLISHMENT, FARNBOROUGH [ENGLAND].
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[AGARD-AR-92] N78-18051
Inviscid fluid models, based on rolled-up vortex sheets, for three-dimensional separation at high Reynolds number
N78-18384
ROYAL INST. OF TECH., STOCKHOLM [SWEDEN].
A note on the stability regions of the backwards differentiation methods
[TRITA-NA-7708] N78-18855
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[TRITA-EPP-77-17] N78-19017
ROYAL NETHERLANDS METEOROLOGICAL INST., DE BILT.
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[KNMI-WR-77-6] N78-18647
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[KNMI-WR-77-5] N78-18669
ROYAL OBSERVATORY, [HONG KONG].
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[TN-21] N78-18621
RUTGERS - THE STATE UNIV., NEW BRUNSWICK, N. J.
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N78-18476

S

SAINT JOHNS RIVER WATER MANAGEMENT DISTRICT, PLATKA, FLA.
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[PB-274015/7] N78-18504
SAN JOSE STATE UNIV., CALIF.
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[PB-274452/2] N78-18588
SANDIA LABS., ALBUQUERQUE, N. MEX.
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[SAND-77-8502] N78-18079
Analytical model of a single axis attitude roll control system
[SAND-77-8256] N78-18164
Microchannel plate response to hard X-rays
[SAND-77-8621] N78-18403
SANTA BARBARA RESEARCH CENTER, GOLETA, CALIF.
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[AD-A048224] N78-18954

Photopolarimetry of scattering surfaces and their interpretation by computer model
[NASA-CR-155305] N78-19013

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RF cell culture irradiation system with controlled temperature and field strength
[PB-274793/9] N78-18712

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[AD-A048174] N78-18324

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[AD-A048262] N78-18875

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[NASA-CR-150516] N78-18522

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[AD-A048045] N78-18398

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N78-19028

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N78-19043

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[PB-274411/8] N78-19001

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[NASA-CR-155932] N78-18519

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[AD-A048594] N78-18865

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The 0.1m subsonic cryogenic tunnel at the University of Southampton
[NASA-CR-145305] N78-18086

SOUTHERN METHODIST UNIV., DALLAS, TEX.
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N78-18772

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[AD-A048197] N78-18957

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[BMVG-FBWT-77-16] N78-18072

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[AD-A048253] N78-18138
Wideband satellite observations
[AD-A048801] N78-18282
Microwave techniques for nondestructive evaluation of ceramics
[AD-A048582] N78-18443
Synthetic liquid fuels development: Assessment of critical factors
N78-18535
Measurement of rate constants of importance in smog
[PB-274530/5] N78-18586
The relation of oxidant levels to precursor emissions and meteorological features. Volume 1: Analysis and findings
[PB-275001/6] N78-18618

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[BMVG-FBWT-77-14] N78-18228

STANFORD RESEARCH INST., MENLO PARK, CALIF.
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[PB-274541/2] N78-18587
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[AD-A048315] N78-18611

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[NASA-CR-155746] N78-18275
An algorithm for testing the planarity of partially oriented graphs
[AD-A048052] N78-18314
On the planarity of hypergraphs
[AD-A048051] N78-18318
Self-similar solutions of dislocation group dynamics and its application to aseismic faulting processes
N78-18448
Solid electrolyte battery materials
[AD-A048330] N78-18559
Time dependent fault mechanics and wave propagation in rocks
N78-18603
Study to develop gradiometer techniques
[AD-A048252] N78-18609
Hardware verification
[AD-A048684] N78-18778
Computing in store
[AD-A048053] N78-18799
Verifying concurrent programs with shared data classes
[AD-A048637] N78-18808
Time-dependent mathematical programs
[AD-A048428] N78-18852
On the distribution of the greatest common divisor
[AD-A048791] N78-18853
Random coverage problems in geometrical probability with an application to time series analysis
N78-18857
A separator theorem for planar graphs
[AD-A048786] N78-18872
Management strategies in fixed structure models of complex organizations, 2
[AD-A048789] N78-18972

STATE UNIV. OF NEW YORK, STONY BROOK.
Convex riemannian manifolds of non-negative curvature
N78-18828

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N78-18944

SULZER BROS. LTD., WINTERTHUR (SWITZERLAND).
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N78-18201

SWEDISH SPACE CORP., SOLNA.
Quick-look capability in a European earth resources satellite data network. Volume 2: Appendices 5 to 7
[FU15-4-VOL-2-APP-5-7] N78-18505

SYRACUSE UNIV., N. Y.
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N78-18153

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[AD-A048577] N78-18807

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[ESA-CR[P]-1008] N78-18916

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Penetration of high explosives by inert projectiles
[AD-A048326] N78-18227
A theory for longitudinal wave propagation in a composite rod: A model for linear elastodynamic behavior of composite penetrators
[AD-A048552] N78-18285

SYSTEMS TECHNOLOGY, INC., HAWTHORNE, CALIF.
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[AD-A048214] N78-18765

T

TECHNICAL UNIV. OF DENMARK, LYNGBY.
Model laws for granular media and powders with a special view to silo models
N78-18235

TECHNION - ISRAEL INST. OF TECH., HAIFA.
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[AD-A048442] N78-18422

TECHNISCHE HOCHSCHULE, AACHEN (WEST GERMANY).
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[DLR-FB-77-28] N78-18015

TECHNISCHE HOGESCHOOL, DELFT (NETHERLANDS).
Mathematical elaboration of the double sliding, free rotating model
N78-18236

TECHNISCHE HOGESCHOOL TWENTE, ENSCHEDE (NETHERLANDS).
Design of a pyro-electric vidicon camera for medical thermography
[THT-TM-77-009] N78-18707
On the possibilities of on-line image restoration by means of a finite impulse response filter
[THT-TM-77-020] N78-18915

TELDIX LUFTFAHRT-AUSRUESTUNGS G.M.B.H., HEIDELBERG (WEST GERMANY).
Magnetic bearing momentum wheels with magnetic gimballing capability for 3-axis active attitude control and energy storage
N78-19031

TELEDYNE BROWN ENGINEERING, HUNTSVILLE, ALA.
Survey: National Environmental Satellite Service
[NASA-CR-150546] N78-18098
Survey: Automated Field Operations and Services (AFOS)
[NASA-CR-150548] N78-18261
Survey: Federal Aviation Administration National Communication Center
[NASA-CR-150552] N78-18262
National Severe Storms Forecast Center
[NASA-CR-150547] N78-18625
Survey: National Meteorological Center
[NASA-CR-150549] N78-18626
NOAA/National Hurricane and Experimental Meteorological Laboratory
[NASA-CR-150550] N78-18627
SESAME/Environmental Research Laboratories
[NASA-CR-150551] N78-18628

TELEDYNE SYSTEMS CO., NORTHRIDGE, CALIF.
LORAN automatic vehicle monitoring system, Phase 1. Volume 1: Test results
[PB-274955/4] N78-18034
LORAN automatic vehicle monitoring system, phase 1. Volume 2: Appendices
[PB-274956/2] N78-18039

TENNESSEE UNIV., KNOXVILLE.
Matrix isolation Fourier transform infrared spectroscopy of polycyclic aromatic hydrocarbons
N78-18146
Matrix isolation fluorescence spectroscopy of polycyclic aromatic hydrocarbons
N78-18147
Theory of tearing and its application to large-scale systems
N78-18813
Effects of two calculus treatments upon achievement and critical thinking ability
N78-18833
A simulation model for the FX-75 relativistic electron beam accelerator
N78-18895
Reflection and absorption of ion-acoustic waves in a plasma density gradient
N78-18926
A Monte Carlo method of solving heat conduction problems
N78-18962

TENNESSEE UNIV. SPACE INST., TULLAHOMA.
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[AD-A048615] N78-18007

TEXACO, INC., BEACON, N. Y.
Optimization of the vehicle-fuel-refinery system
N78-18533

TEXAS A&M UNIV., COLLEGE STATION.
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[E78-10073] N78-18482
JSME scatterometer data processing
[NASA-CR-151639] N78-18494
Real-time computer techniques in the detection and analysis of severe storms from digital radar data
N78-18622
Reflection and refraction of solitary waves: A numerical investigation
N78-18659
Oceanographic station data collected aboard R/V Melville during FDRAKE 75
[PB-274442/3] N78-18668

TEXAS CHRISTIAN UNIV., FORT WORTH.
A note on the dynamic correlation coefficient
[AD-A047654] N78-18985

TEXAS INSTRUMENTS, INC., DALLAS.
Microstrip reflectarray antenna program
[AD-A048480] N78-18337
Microbeam analysis techniques for ICS
[AD-A048482] N78-18338
IC fabrication using electron-beam technology
[AD-A048307] N78-18886

TEXAS TECHNOLOGICAL UNIV., LUBBOCK.
Selected design parameters for reclining seats based on engineering anthropometry
[AD-A048458] N78-18769

Development of an unconventional approach to nitrification-dentrification
[PB-274398/7] N78-19003
TEXAS UNIV., AUSTIN.
The synthesis and study of some novel organo-transition metal compounds
N78-18172
Studies of carbon monoxide and oxygen chemisorbed on palladium and related metals
N78-18173
Diffusion in a temperature gradient
N78-18346
Sleep wakefulness determinations from heart rate data, volume 3
[AD-A045817] N78-18703
The analysis and synthesis of some advanced techniques for digital simulation
N78-18792
Network versus linear programming algorithms and implementations
[AD-A048296] N78-18804
An evaluation of mathematical programming and minicomputers
[AD-A048299] N78-18805
Generalized networks: A fundamental computer-based planning tool
[AD-A048297] N78-18814
Application of sensitivity theory and optimization techniques to models of large scale systems
N78-18864
Coupled-channel analysis for heavy-ion induced scattering and transfer reactions
N78-18894
The effects of transition layers between CVD-vanadium dioxide films and oxide substrates
N78-18947
Photometric study of the structure of lenticular galaxies
N78-19009
THOMSON-CSF, MEUDON-LA-FORET (FRANCE).
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[ESA-CR(P)-968] N78-18114
TORONTO UNIV. (ONTARIO).
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[UTIAS-215] N78-18077
Theory of wind turbines with contrarotation
[UTIAS-218] N78-18556
Subsonic gas target 14 MeV neutron generator
N78-18896
TRANSPORTATION RESEARCH BOARD, WASHINGTON, D. C.
Transit Planning and Operations
[PB-274535/4] N78-19004
TRANSPORTATION SYSTEMS CENTER, CAMBRIDGE, MASS.
Characterization of current tower cab environments
[AD-A048306] N78-18026
Measurement and simulation of fuel consumption in rail freight service
N78-18545
TRW DEFENSE AND SPACE SYSTEMS GROUP, REDONDO BEACH, CALIF.
Microwave simulation of laser plasma interactions
[UCRL-13752] N78-18423
Positive commandable oiler for satellite bearing lubrication
N78-19035

U

UNION COLL., SCHENECTADY, N.Y.
Effects of Energy Constraints on Transportation Systems
N78-18529
UNITED AIRCRAFT CORP., EAST HARTFORD, CONN.
Emergency space-suit helmet
[NASA-CASE-MSC-10954-1] N78-18761
UNIVERSITY OF SOUTHERN CALIF., MARINA DEL REY.
On the use of programming knowledge to understand informal process description
[AD-A048153] N78-18802
The inference of domain structure from informal process descriptions
[AD-A048154] N78-18825
URBAN MASS TRANSPORTATION ADMINISTRATION, WASHINGTON, D.C.
The energy efficiency of urban transit systems
N78-18541
UTAH UNIV., SALT LAKE CITY.
Finite element solution to equations for turbulent motion and diffusion in planetary boundary layer
N78-18605
Boundary value problems and periodic solutions of nonlinear ordinary, functional and partial differential equations
[AD-A048170] N78-18850

V

VANDERBILT UNIV., NASHVILLE, TENN.
On continuous rings
N78-18870
VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG.
A new experimental method for the accelerated characterization of composite materials
[VPI-E-78-3] N78-18132
Measured Reynolds stress tensors in a three-dimensional turbulent boundary layer
N78-18361
VIRGINIA UNIV., CHARLOTTESVILLE.
Optimal aircraft simulator development by adaptive random search optimization
N78-18087
Amalgam stabilization by selective interfacial amalgamation
N78-18178
Computer model for vacancy-surface interactions in bcc metals
N78-18180
Ductile fracture initiation in pure alpha-FE
N78-18181
LANDSAT application of remote sensing to shoreline-form analysis
[E78-10079] N78-18488
Some applications of discrete analog signal processing to pattern recognition
N78-18818
VOUGHT CORP., HAMPTON, VA.
A procedure for the determination of the effect of fuselage nose bluntness on the wave drag of supersonic cruise aircraft
[NASA-CR-145306] N78-17994

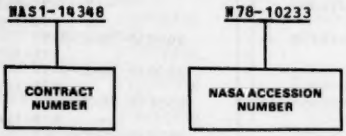
W

WARSAW UNIV. (POLAND).
On the non-standard formulation of mechanics
N78-18237
WASHINGTON UNIV., SEATTLE.
Application of system identification to analytic rotor modeling from simulated and wind tunnel dynamic test data
N78-18040
Video fluorometry: A novel approach to the acquisition and interpretation of multicomponent fluorescence data
N78-18142
Momentum distributions and one-body density matrices of the quantum fluids
N78-18348
RF cell culture irradiation system with controlled temperature and field strength
[PB-274793/9] N78-18712
Low-energy electron diffraction from epitaxial solid krypton layers on graphite
N78-18946
Potential for betterment district financing and joint development applications to surface transit
[PB-274618/8] N78-19005
WASHINGTON UNIV., ST. LOUIS, MO.
An examination of combined free and forced convection phenomena in a density-stratified fluid
N78-18353
WEIDLINGER ASSOCIATES, NEW YORK.
Transient response of shells with internally attached structures
[AD-A048167] N78-18462
Dynamic response of a submerged elastic structure with elastic structures attached to it by inelastic springs
[AD-A048166] N78-18463
WENTZ (FRANK J.) AND ASSOCIATES, CAMBRIDGE, MASS.
A two-scale scattering model with application to the JONSWAP '75 aircraft microwave scatterometer experiment
[NASA-CR-2919] N78-18662
WESTINGHOUSE DEFENSE AND ELECTRONIC SYSTEMS CENTER, BALTIMORE, MD.
F-4E avionics update
[AD-A047949] N78-18061
Building block modules: Frequency synthesizer and amplifier-mixer
[AD-A048209] N78-18320
WESTINGHOUSE ELECTRIC CORP., BALTIMORE, MD.
Modular packaging approaches
[AD-A048205] N78-18321
WESTINGHOUSE ELECTRIC CORP., PITTSBURGH, PA.
Magnifying image intensifier
[NASA-CASE-GSC-12010-1] N78-18905
WESTINGHOUSE ELECTRIC CORP., TRAFFORD, PA.
A system for delivering SiCl4 to a chemical reactor
[NASA-CASE-NPO-14383-1] N78-18253
WHITE SANDS MISSILE RANGE, N.MEX.
Segmentation and structure analysis for real-time video target tracking
[AD-A048156] N78-18270
WISCONSIN UNIV., MADISON.
An experimental determination of the history of formation of the cylinder averaged oxides of nitrogen in diesel combustion
N78-18143
Emission formation in heterogeneous combustion
[PB-274599/0] N78-18163
A physically based climate model of hemispheric mean surface temperature with predictive capability
N78-18620
The filtering of images using a new fidelity criterion
[PB-274532/1] N78-18787
Quantization of image transforms with minimum distortion
[PB-274533/9] N78-18788
Fake quaternionic projective spaces from a homotopy point of view
N78-18869
A poloidal divertor model for Tokamak fusion reactors
N78-18924
Venus stratospheric circulation: A diagnostic study
N78-19019
WISCONSIN UNIV., MILWAUKEE.
Totally and partially ambiguous points of planar functions
N78-18834
WORLD METEOROLOGICAL ORGANIZATION, GENEVA (SWITZERLAND).
Compendium of training facilities in environmental problems related to meteorology and operational hydrology
[WMO-489] N78-18644
Guide to marine meteorological services
[WMO-471] N78-18645
Compendium of meteorological training facilities, fifth edition
[WMO-240] N78-18649
Compendium of meteorology. Volume 2, part 1: General hydrology
[WMO-364] N78-18650
World Weather Watch. International global data-processing system plan to support the first GARP global experiment
[WMO-469] N78-18651
Hydrological application of atmospheric vapour-flux analyses
[WMO-476] N78-18652
WYLE LABS., INC., HUNTSVILLE, ALA.
Indoor thermal performance evaluation of Daystar solar collector
[NASA-CR-150511] N78-18521
Thermal performance of MSFC hot air collectors under natural and simulated conditions
[NASA-CR-150506] N78-18525

Y

YALE UNIV., NEW HAVEN, CONN.
Structure and intramolecular interconversions of some organometallic complexes
N78-18170
The process of question answering
N78-18790
Design of a production system for cognitive modelling number 1
[AD-A048196] N78-18826
Frequency spreading in forward surface scattering
[AD-A048741] N78-18877
Electron scattering from vibrationally excited nitrogen
N78-18881
The development of a parallel-channel spectrographic detector: Applications to Raman scattering
N78-18903
Evolution of a test particle distribution function in a partially ionized plasma
N78-18923
YUGOSLAV ACADEMY OF SCIENCES AND ARTS, ZAGREB.
Biological significance of some metals as air pollutants. Part 1, lead
[PB-274055/3] N78-18585

Typical Contract Number Index Listing



Listings in this index are arranged alphanumerically by contract number. Under each contract number the NASA accession numbers denoting documents that have been produced as a result of research done under that contract are arranged in ascending order. The NASA accession number denotes the number by which the citation is identified.

AF PROJ. 666A
N78-18397
AF PROJ. 1227
N78-18111
AF PROJ. 1256
N78-18419
AF PROJ. 1467
N78-18467
AF PROJ. 2007
N78-18898
AF PROJ. 2051
N78-18063
AF PROJ. 2052
N78-18065
AF PROJ. 2128
N78-18099
N78-18113
N78-18912
AF PROJ. 2304
N78-18840
N78-18843
AF PROJ. 2310
N78-18613
AF PROJ. 3164
N78-18776
AF PROJ. 5597
N78-18824
AF PROJ. 7071
N78-18840
AF PROJ. 8607
N78-18609
AF-AFOSR-2679-74
N78-18031
ARPA ORDER 1366
N78-19014
ARPA ORDER 2180
N78-18328
ARPA ORDER 2223
N78-18802
N78-18825
ARPA ORDER 2322
N78-18401
ARPA ORDER 2397
N78-18345
ARPA ORDER 2494
N78-18778
ARPA ORDER 2840
N78-18420
ARPA ORDER 3441
N78-18961
AT/2057/048-ARL
N78-18373
DA MIPR 14-74
N78-18277
DA MIPR 16-75
N78-18277
DA MIPR 20-76
N78-18277
DA PROJ. 1L7-62720-D-048
N78-18578
DA PROJ. 1R7-65706-M-541
N78-18844
DA PROJ. 1T1-61101-A-91A
N78-18274
N78-18465
DA PROJ. 1T1-61102-B-32D
N78-18193
DA PROJ. 1T1-62102-AH-84
N78-18214
DA PROJ. 1T1-62105-AH-84
N78-18216
DA PROJ. 1T1-62111-AH-71
N78-18636
DA PROJ. 1T6-65702-D-127
N78-18639
N78-18642
N78-18643
DA PROJ. 4A7-62720-A-896
N78-18503
DA-ARO-(D)-31-124-72-G168
N78-18367
DA-ERO-75-G-012
N78-18422
DAAA23-76-C-0104
N78-18577
DAAB07-75-C-0045
N78-18334
N78-18335
DAAB07-76-C-0026
N78-18315
DAAB07-76-C-8105
N78-18886
DAAB07-76-C-8119
N78-18331
DAAB07-77-C-0375
N78-18416
DAAD05-74-C-0722
N78-18865
DAAG29-74-C-0032
N78-18852
DAAG29-75-G-0191
N78-18910
DAAG29-76-C-0023
N78-18611
DAAG29-76-C-0035
N78-18858
DAAG29-76-C-0049
N78-18227
DAAG29-76-D-0100
N78-18421
N78-18636
DAAG29-76-G-0186
N78-18850
DAAG29-76-G-0189
N78-18417
DAAG29-76-G-0248
N78-18141
DAAG29-77-G-0031
N78-18853
N78-18972
DAAG29-78-G-0010
N78-18882
DAAG46-76-C-0048
N78-18443
DAAG46-77-C-0017
N78-18137
DAAG53-76-C-0184
N78-18914
DAAJ02-76-C-0028
N78-18054
DAAK02-74-C-0388
N78-18327
DAAK10-77-C-0121
N78-18908
DAAK70-76-C-0239
N78-18432
DAAK70-77-C-0111
N78-18399
DAA29-76-G-0248
N78-18141
DAHC04-67-C-0008
N78-18361
DAHC04-74-C-0208
N78-18850
DAHC04-74-G-0134
N78-18189
DAHC04-74-G-0167
N78-18141
DAHC04-75-G-0021
N78-18884
DAHC04-75-G-0175
N78-18850
DAHC15-72-C-0308
N78-18802
N78-18825
DAHC15-73-C-0200
N78-18332
DAHC15-73-C-0370
N78-18412
DAJA37-74-C-1309
N78-18193
DAMD17-74-C-4081
N78-18703
DASG60-77-C-0095
N78-18093
DCA100-73-C-0015
N78-18784
DI-14-34-0001-6045
N78-19003
DI-14-34-0001-7091
N78-19003
DNA001-75-C-0111
N78-18282
DNA001-77-C-0012
N78-18272
DOT-FA67NF-AP-21
N78-18158
DOT-FA70WA-2448
N78-18036
N78-18037
N78-18038
DOT-FA70WAI-175
N78-18032
DOT-FA74WAI-448
N78-18264
DOT-FA74WAI-495
N78-18641
DOT-FA75WA-3688
N78-18069
DOT-FA77WAI-727
N78-18027
DOT-OS-70074 N78-18805
DOT-TSC-RA-75-10
N78-18437
N78-18438
DOT-TSC-1238-1
N78-18034
DOT-TSC-1238-2
N78-18039
DOT/TSC-RA-75-10
N78-18439
N78-18440
EC-77-A-31-1011
N78-18988
EC-77-G-01-60-67
N78-18529
EPA-R-802235 N78-18588
EPA-R-802288 N78-18586
EPA-R-803292 N78-18992
EPA-R-803858-01-1
N78-18163
EPA-T-900574-01-0
N78-19001
EPA-68-01-0162
N78-18999
EPA-68-01-2430
N78-18998
EPA-68-01-2940
N78-18587
EPA-68-02-1226
N78-18713
EPA-68-02-1321
N78-18566
EPA-68-02-1366
N78-18565
EPA-68-02-1376
N78-18593
EPA-68-02-1869
N78-18589
EPA-68-02-2084
N78-18618
EPA-68-03-2353
N78-18597
EPA-68-03-2412
N78-18580
EPA-803095 N78-18675
ESA-SC/128-HQ
N78-18505
ESA-1/432 N78-18979
ESA-771/75-AR-SC
N78-18916
ESTEC-2311/74-AK
N78-18563
ESTEC-2525/75-HP(SC)
N78-18114
ESTEC-2569/75-HP-SC
N78-18405
EY-76-C-02-3073
N78-18938
N78-18940
N78-18941
EY-76-C-04-0789
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N78-18403
EY-76-S-02-2456
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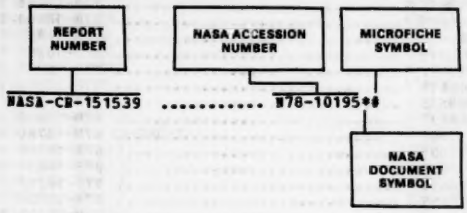
EY-76-S-02-2798
N78-18939
FAA PROJ. 022-243-510
N78-18260
FAA PROJ. 052-241-04
N78-18027
FAA PROJ. 154-451-110
N78-18021
F04701-72-C-0203
N78-18033
F04701-77-C-0078
N78-18161
N78-18369
N78-19025
F08606-77-C-0008
N78-18913
F19628-74-C-0162
N78-18609
F19628-76-C-0002
N78-18099
N78-18466
F19628-76-C-0017
N78-18032
F19628-76-C-0236
N78-18807
F19628-76-C-0249
N78-18328
F19628-76-C-0266
N78-18317
F19628-77-C-0001
N78-18806
F19628-77-C-0010
N78-18613
F19628-78-C-0002
N78-18027
N78-18113
N78-18911
N78-18912
F29601-76-C-0055
N78-18419
F29601-76-C-0125
N78-18324
F30601-73-C-0155
N78-18401
F30602-72-C-0036
N78-18501

F30602-72-C-0193 N78-18824
F30602-73-C-0036 N78-18502
F30602-75-C-0294 N78-18800
F30602-76-C-0105 N78-18316
F30602-76-C-0226 N78-18337
F30602-76-C-0316 N78-18338
F30602-76-C-0373 N78-18824
F30602-76-C-0419 N78-18271
F33615-73-C-1221 N78-18062
F33615-73-C-5013 N78-18162
F33615-74-C-1234 N78-18397
F33615-75-C-1206 N78-18065
F33615-75-C-1239 N78-18029
F33615-75-C-1245 N78-18320
F33615-75-C-1269 N78-18321
F33615-75-C-1301 N78-18030
F33615-75-C-5013 N78-18769
F33615-75-C-5061 N78-18198
F33615-75-C-5218 N78-18063
F33615-76-C-1115 N78-18269
F33615-76-C-1159 N78-18398
F33615-76-C-1182 N78-18064
F33615-76-C-1306 N78-18319
F33615-76-C-1327 N78-18776
F33615-76-C-1339 N78-18322
F33615-76-C-1340 N78-18061
F33615-76-C-2092 N78-18071
F33615-76-C-5072 N78-18138
F33615-76-C-5162 N78-18140
F40600-74-C-0009 N78-18007
F44620-76-C-0121 N78-18957
HL-14388 N78-18678 N78-18701
HL-16149 N78-18701
HL-18083 N78-18678
HUD-H-2106R N78-18990 N78-18994 N78-18996 N78-18997
HUD-H-2341 N78-18995
JPL-954363 N78-18516
JPL-954506 N78-18517
JPL-954560 N78-18518
JPL-954589 N78-18253
JPL-954606 N78-18519
MDA903-76-C-0206 N78-18778
MIRS-5462 N78-18701
NASA ORDER P-57270-G N78-18798
NASA ORDER P-57579-G N78-18661
NASW-2532 N78-18975
NASW-2762 N78-19025
NASW-2790 N78-18307 N78-18309 N78-18310 N78-18490
N78-18491 N78-18953
NASW-2791 N78-18041 N78-18699 N78-18927
NASW-2792 N78-18097 N78-18492 N78-18989
NASW-2879 N78-19025
NASW-2899 N78-18975
NASW-2909 N78-19016
NASW-2985 N78-19013
NASW-2992 N78-18975
NAS1-10843 N78-18458
NAS1-13290 N78-18028
NAS1-13500 N78-17994
NAS1-13624 N78-17990
NAS1-14330 N78-18662
NAS1-14643 N78-18359
NAS1-14644 N78-18797
NAS1-14797 N78-18874
NAS2-8300 N78-19029
NAS3-17817 N78-18251
NAS3-17866 N78-17991
NAS3-18559 N78-18411
NAS3-18926 N78-18131
NAS3-19751 N78-18460
NAS3-20108 N78-18515
NAS3-20608 N78-18070
NAS4-2020 N78-18393
NAS4-2378 N78-18000
NAS5-2304 N78-18483
NAS5-20999 N78-18488
NAS5-22534 N78-18482
NAS5-23740 N78-18631
NAS5-23788 N78-19025
NAS6-2637 N78-18265
NAS7-100 N78-18253 N78-18266 N78-18395 N78-18396 N78-18495 N78-18516 N78-18517 N78-18518 N78-18519 N78-18528 N78-18702 N78-18897 N78-19041
NAS8-31100 N78-18520
NAS8-31290 N78-19036
NAS8-31841 N78-18573
NAS8-32024 N78-18623
NAS8-32036 N78-18521 N78-18523 N78-18524 N78-18525 N78-18527
NAS8-32246 N78-18526
NAS8-32260 N78-18522
NAS8-32539 N78-18098 N78-18261 N78-18262 N78-18625 N78-18626 N78-18627 N78-18628
NAS8-32613 N78-18119
NAS9-11539 N78-19021
NAS9-14769 N78-18212
NAS9-14875 N78-18494
NAS9-14970 N78-18493
NAS9-15000 N78-18871
NAS9-15171 N78-18096
NAS9-15200 N78-18484 N78-18496 N78-18624
NAS9-15244 N78-18700
NAS9-15283 N78-18485
NAS9-15362 N78-18487
NAS9-15409 N78-18259
NAS9-15502 N78-18118
NAS10-8982 N78-18224
NBS-5-35912 N78-18345
NGL-02-001-092 N78-18486
NGL-05-020-014 N78-18275
NGR-14-001-008 N78-18024
NGR-38-003-036 N78-18882 N78-18884
NGR-39-009-275 N78-18068
NGT-01-002-095 N78-18090
NIOSH-IA-75-16 N78-18714
NIOSH-IA-75-30 N78-18712
NIVR-1737 N78-18371
NIVR-1754 N78-18009
NOAA-04-4-022-17 N78-18671
NOAA-04-4-158-1 N78-18024
NOAA-04-4-158-24 N78-18986
NR PROJ. 042-271 N78-18849
NR PROJ. 047-021 N78-18804 N78-18805
NR PROJ. 083-102 N78-18664
NR PROJ. 097-398 N78-18431
NR PROJ. 154-399 N78-18826
NR PROJ. 170-801 N78-18969
NSF AER-75-00280-A02 N78-18568
NSF APR-76-12036 N78-18434 N78-18435
NSF C-724 N78-18795
NSF DMR-74-15224 N78-18197
NSF DSI-76-05644 N78-18975
NSF ENG-74-21258 N78-18464
NSF ENG-75-10545 N78-18787 N78-18788
NSF ENV-76-18492 N78-18991
NSF ISR-75-20393 N78-18592
NSF MCS-74-08921-A02 N78-19000
NSF MCS-75-22870 N78-18872
NSF PRA-76-81015 N78-18534
NSF-DCR-75-04060 N78-18783
NSF-ID074-14941-A01 N78-18668
NSG-1046 N78-17993
NSG-1244 N78-17996
NSG-1312 N78-18822
NSG-2038 N78-18132
NSG-3012 N78-17995
NSG-3086 N78-18883
NSG-3126 N78-18672
NSG-7172 N78-18086
NSG-9033 N78-18500
NSG-9060 N78-18678 N78-18701
N00014-67-A-0369-0007 N78-18664
N00014-67-A-0369-0012 N78-18664
N00014-72-C-0119 N78-18462 N78-18463
N00014-73-C-0408 N78-18215
N00014-74-C-0240 N78-18400
N00014-75-C-0299 N78-18664
N00014-75-C-0426 N78-18966
N78-18967 N78-18968
N00014-75-C-0451 N78-18801 N78-18842 N78-18847 N78-18848 N78-18849 N78-18851 N78-18859
N00014-75-C-0455 N78-18860
N00014-75-C-0457 N78-18803
N00014-75-C-0478 N78-18413
N00014-75-C-0542 N78-18218
N00014-75-C-0569 N78-18804 N78-18805 N78-18814
N00014-75-C-0601 N78-18275 N78-18314 N78-18318 N78-18799
N00014-75-C-0616 N78-18804 N78-18814
N00014-75-C-0621 N78-18970
N00014-75-C-0661 N78-18783
N00014-75-C-0669 N78-18430
N00014-75-C-0761 N78-18431
N00014-75-C-0860 N78-18464
N00014-75-C-0957 N78-18955
N00014-75-C-0970 N78-18197
N00014-75-C-0973 N78-18969
N00014-75-C-0982 N78-18774
N00014-75-C-1012 N78-18185 N78-18187
N00014-75-C-1014 N78-18877
N00014-75-C-060123 N78-18808
N00014-76-C-0067 N78-18664
N00014-76-C-0105 N78-18217
N00014-76-C-0121 N78-18959 N78-18960
N00014-76-C-0200 N78-18219
N00014-76-C-0319 N78-18414
N00014-76-C-0383 N78-18805 N78-18814
N00014-76-C-0391 N78-18841
N00014-76-C-0409 N78-18194 N78-18195 N78-18196
N00014-76-C-0475 N78-18853 N78-18972
N00014-76-C-0488 N78-18875
N00014-76-C-0605 N78-18280
N00014-76-C-0616 N78-18805
N00014-76-C-0635 N78-18101
N00014-76-C-0688 N78-18872

N00014-76-C-0692 N78-18461
N00014-76-C-0781 N78-18977
N00014-76-C-0940 N78-18559
N00014-76-C-1077 N78-18956
N00014-77-C-0008 N78-18365
N00014-77-C-0100 N78-18420
N00014-77-C-0114 N78-18760
N00014-77-C-0125 N78-18985
N00014-77-C-0237 N78-18877
N00014-77-C-0240 N78-18160
N00014-77-C-0242 N78-18826
N00014-77-C-0394 N78-18663
N00014-77-C-0468 N78-18285
N00014-77-C-0542 N78-18961
N00019-76-C-0143 N78-18055
N00019-77-C-0131 N78-18633
N00039-77-C-0255 N78-18782
N00123-74-C-0312 N78-18283
N00173-76-C-0316 N78-18954
N00173-76-C-0395 N78-18279
N00228-76-C-2129 N78-18635
N00383-73-C-3318 N78-18441
N60530-77-M-H604 N78-18765
N61339-74-C-0141 N78-18087
N62269-75-C-0274 N78-18333
N62269-76-C-0382 N78-18008
OWRT PROJ. A-035-TEX(1) N78-19003
PHS-CDC-210-76-0136 N78-18711
RNLAF-RB-KL-1973/74/75-C4 N78-18475
RR-59 N78-18701
RR0110941 N78-18336 N78-18368
RR0210101 N78-18267
RR0420401 N78-18826
RR0420417 N78-18826
SFCP-02-302-3 N78-18585
SF33354316 N78-18225
SRC-B/RG/64915 N78-18917 N78-18918 N78-18919
T/RF-22/RF-220/31041 N78-18899
T/RF-41/RF-410/41110 N78-18072
T/RF-41/RF-410/51082 N78-18057
T/RF-41/RF-410/51106 N78-18013
T/RF-51/RF-510/41084 N78-18228
TP-7AC024 N78-18705
W-7405-ENG-26 N78-18340 N78-18937
W-7405-ENG-36 N78-18404 N78-18936
W-7405-ENG-48 N78-18200 N78-18220 N78-18423 N78-18888 N78-18940
YF5354011 N78-18323
YF52556091 N78-18366
ZR0111204 N78-18909
ZR0130901 N78-18225
1R7-65706-M-541 N78-18865
141-95-01-19 N78-18572
161-09-01-01 N78-18662
505-02-31-02 N78-18796
505-02-41 N78-18133 N78-18134
505-06-13-04 N78-18358
505-06-33-09 N78-18085
505-07-13-02 N78-18822
505-07-22-01 N78-18263
505-08-21 N78-18127
505-09-13-11 N78-18873
505-10-13-01 N78-18044
505-10-14 N78-18042
505-11-16-07 N78-17993
506-19-13-01 N78-18252
506-26-10-01 N78-18363
506-26-20-01 N78-18362
513-53-05 N78-18025
743-01-01-04 N78-18135
743-05-04-01 N78-18459
750-01-23-04 N78-18117
750-02-01-02 N78-18105
992-21-01-90-01 N78-18043

Typical Report/Accession Number Index Listing



Listings in this index are arranged alphanumerically by report number. The NASA accession number denotes the number by which the citation is identified. An asterisk (*) indicates that the item is a NASA report. A pound sign (#) indicates that the item is available on microfiche. Accession numbers followed by a plus sign (+) are not available on microfiche because of size or reproducibility.

A-6973 ..... N78-18025*#
A-7221 ..... N78-17999*#
A-7297 ..... N78-18127*#
A-7301-PT-1 ..... N78-18043*#

AC-77-03 ..... N78-18595 #

AD-A04788 ..... N78-18260 #
AD-A045817 ..... N78-18703 #
AD-A047647 ..... N78-18705 #
AD-A047649 ..... N78-18767 #
AD-A047654 ..... N78-18985 #
AD-A047776 ..... N78-18843 #
AD-A047780 ..... N78-18632 #
AD-A047781 ..... N78-18845 #
AD-A047782 ..... N78-18777 #
AD-A047783 ..... N78-18846 #
AD-A047795 ..... N78-18574 #
AD-A047826 ..... N78-18575 #
AD-A047830 ..... N78-18159 #
AD-A047838 ..... N78-18764 #
AD-A047850 ..... N78-18136 #
AD-A047864 ..... N78-18977 #
AD-A047871 ..... N78-18840 #
AD-A047880 ..... N78-18967 #
AD-A047886 ..... N78-18063 #
AD-A047888 ..... N78-18970 #
AD-A047889 ..... N78-18774 #
AD-A047901 ..... N78-18412 #
AD-A047903 ..... N78-18315 #
AD-A047916 ..... N78-18267 #
AD-A047917 ..... N78-18268 #
AD-A047925 ..... N78-18558*#
AD-A047926 ..... N78-18431 #
AD-A047940 ..... N78-18189 #
AD-A047948 ..... N78-18860 #
AD-A047949 ..... N78-18061 #
AD-A047953 ..... N78-18275*#
AD-A047956 ..... N78-18214 #
AD-A047957 ..... N78-18187 #
AD-A047960 ..... N78-18432 #
AD-A047963 ..... N78-18185 #
AD-A047965 ..... N78-18966 #
AD-A047966 ..... N78-18969 #
AD-A047968 ..... N78-18225 #
AD-A047971 ..... N78-18053 #
AD-A047980 ..... N78-18633 #
AD-A047982 ..... N78-18461 #
AD-A047986 ..... N78-18272 #
AD-A047991 ..... N78-18273 #
AD-A047992 ..... N78-18274 #
AD-A047996 ..... N78-18366 #
AD-A047997 ..... N78-18322 #
AD-A047998 ..... N78-18064 #
AD-A047999 ..... N78-18111 #
AD-A048000 ..... N78-18030 #
AD-A048008 ..... N78-18031 #
AD-A048010 ..... N78-18413 #
AD-A048037 ..... N78-18557 #
AD-A048045 ..... N78-18398 #
AD-A048048 ..... N78-19014 #
AD-A048051 ..... N78-18318 #
AD-A048052 ..... N78-18314 #
AD-A048053 ..... N78-18799 #
AD-A048055 ..... N78-18099 #
AD-A048057 ..... N78-18323 #
AD-A048059 ..... N78-18188 #
AD-A048064 ..... N78-18325 #
AD-A048065 ..... N78-18186 #
AD-A048066 ..... N78-18978 #
AD-A048067 ..... N78-18277 #
AD-A048069 ..... N78-18326 #
AD-A048070 ..... N78-18288 #
AD-A048072 ..... N78-18841 #
AD-A048076 ..... N78-18137 #
AD-A048077 ..... N78-18958 #
AD-A048106 ..... N78-18503 #
AD-A048108 ..... N78-18216 #
AD-A048109 ..... N78-18278 #
AD-A048110 ..... N78-18002 #
AD-A048115 ..... N78-18876 #
AD-A048116 ..... N78-18607 #
AD-A048117 ..... N78-18608 #
AD-A048122 ..... N78-18704 #
AD-A048124 ..... N78-18803 #
AD-A048125 ..... N78-18851 #
AD-A048126 ..... N78-18849 #
AD-A048127 ..... N78-18859 #
AD-A048151 ..... N78-18848 #
AD-A048152 ..... N78-18847 #
AD-A048153 ..... N78-18802 #
AD-A048154 ..... N78-18825 #
AD-A048156 ..... N78-18270 #
AD-A048157 ..... N78-18636 #
AD-A048159 ..... N78-18276 #
AD-A048163 ..... N78-18909 #
AD-A048166 ..... N78-18463 #
AD-A048167 ..... N78-18462 #
AD-A048168 ..... N78-18635 #
AD-A048170 ..... N78-18850 #
AD-A048173 ..... N78-18908 #
AD-A048174 ..... N78-18324 #
AD-A048175 ..... N78-18271 #
AD-A048180 ..... N78-18844 #
AD-A048188 ..... N78-18215 #
AD-A048189 ..... N78-18112 #
AD-A048191 ..... N78-18397 #
AD-A048193 ..... N78-18269 #
AD-A048194 ..... N78-18956 #
AD-A048195 ..... N78-18775 #
AD-A048196 ..... N78-18826 #
AD-A048197 ..... N78-18957 #
AD-A048198 ..... N78-18062 #
AD-A048199 ..... N78-18365 #
AD-A048200 ..... N78-18776 #
AD-A048201 ..... N78-18095 #
AD-A048204 ..... N78-18029 #
AD-A048205 ..... N78-18321 #
AD-A048207 ..... N78-18319 #
AD-A048208 ..... N78-18824 #
AD-A048209 ..... N78-18320 #
AD-A048210 ..... N78-18907 #
AD-A048214 ..... N78-18765 #
AD-A048216 ..... N78-18960 #
AD-A048217 ..... N78-18959 #
AD-A048220 ..... N78-18501 #
AD-A048221 ..... N78-18502 #
AD-A048222 ..... N78-18316 #
AD-A048224 ..... N78-18954 #
AD-A048228 ..... N78-18968 #
AD-A048229 ..... N78-18414 #
AD-A048231 ..... N78-18800 #
AD-A048244 ..... N78-18441 #
AD-A048248 ..... N78-18801 #
AD-A048249 ..... N78-18842 #
AD-A048252 ..... N78-18609 #
AD-A048253 ..... N78-18138 #

AD-A048254 ..... N78-18965 #
AD-A048261 ..... N78-18955 #
AD-A048262 ..... N78-18875 #
AD-A048264 ..... N78-18317 #
AD-A048266 ..... N78-18430 #
AD-A048268 ..... N78-18858 #
AD-A048271 ..... N78-18634 #
AD-A048272 ..... N78-18643 #
AD-A048273 ..... N78-18642 #
AD-A048274 ..... N78-18001 #
AD-A048276 ..... N78-18329 #
AD-A048287 ..... N78-18911 #
AD-A048288 ..... N78-18027 #
AD-A048289 ..... N78-18197 #
AD-A048290 ..... N78-18783 #
AD-A048295 ..... N78-18281 #
AD-A048296 ..... N78-18804 #
AD-A048297 ..... N78-18814 #
AD-A048299 ..... N78-18805 #
AD-A048300 ..... N78-18113 #
AD-A048301 ..... N78-18465 #
AD-A048305 ..... N78-18639 #
AD-A048306 ..... N78-18026 #
AD-A048307 ..... N78-18886 #
AD-A048311 ..... N78-18885 #
AD-A048315 ..... N78-18611 #
AD-A048317 ..... N78-18780 #
AD-A048319 ..... N78-18779 #
AD-A048321 ..... N78-18640 #
AD-A048326 ..... N78-18227 #
AD-A048327 ..... N78-18417 #
AD-A048328 ..... N78-18910 #
AD-A048330 ..... N78-18559 #
AD-A048331 ..... N78-18065 #
AD-A048332 ..... N78-18577 #
AD-A048333 ..... N78-18217 #
AD-A048336 ..... N78-18442 #
AD-A048345 ..... N78-18286 #
AD-A048346 ..... N78-18610 #
AD-A048352 ..... N78-18629 #
AD-A048353 ..... N78-18781 #
AD-A048354 ..... N78-18021 #
AD-A048360 ..... N78-18078 #
AD-A048361 ..... N78-18418 #
AD-A048428 ..... N78-18852 #
AD-A048430 ..... N78-18141 #
AD-A048432 ..... N78-19025*#
AD-A048442 ..... N78-18422 #
AD-A048445 ..... N78-18369 #
AD-A048448 ..... N78-18193 #
AD-A048449 ..... N78-18327 #
AD-A048450 ..... N78-18008 #
AD-A048455 ..... N78-18219 #
AD-A048458 ..... N78-18769 #
AD-A048464 ..... N78-18401 #
AD-A048466 ..... N78-18961 #
AD-A048475 ..... N78-18158 #
AD-A048478 ..... N78-18784 #
AD-A048480 ..... N78-18337 #
AD-A048481 ..... N78-18613 #
AD-A048482 ..... N78-18338 #
AD-A048483 ..... N78-18328 #
AD-A048484 ..... N78-18914 #
AD-A048485 ..... N78-18055 #
AD-A048497 ..... N78-18101 #
AD-A048498 ..... N78-18087 #
AD-A048527 ..... N78-18190 #
AD-A048528 ..... N78-18006 #
AD-A048533 ..... N78-18415 #
AD-A048551 ..... N78-18071 #
AD-A048552 ..... N78-18285 #
AD-A048553 ..... N78-18093 #
AD-A048555 ..... N78-18003 #
AD-A048559 ..... N78-18827 #
AD-A048565 ..... N78-18139 #
AD-A048574 ..... N78-18766 #
AD-A048576 ..... N78-18806 #
AD-A048577 ..... N78-18807 #
AD-A048578 ..... N78-18335 #
AD-A048579 ..... N78-18334 #
AD-A048580 ..... N78-18054 #
AD-A048581 ..... N78-18664 #
AD-A048582 ..... N78-18443 #
AD-A048587 ..... N78-18162 #
AD-A048589 ..... N78-18032 #
AD-A048590 ..... N78-18069 #
AD-A048593 ..... N78-18198 #
AD-A048594 ..... N78-18865 #
AD-A048596 ..... N78-18333 #
AD-A048597 ..... N78-18161 #
AD-A048598 ..... N78-18421 #
AD-A048599 ..... N78-18400 #
AD-A048601 ..... N78-18854 #
AD-A048602 ..... N78-18331 #
AD-A048603 ..... N78-18641 #
AD-A048604 ..... N78-18284 #
AD-A048605 ..... N78-18466 #
AD-A048609 ..... N78-18861 #
AD-A048610 ..... N78-18332 #
AD-A048611 ..... N78-18264 #
AD-A048612 ..... N78-18033 #
AD-A048614 ..... N78-18913 #
AD-A048615 ..... N78-18007 #
AD-A048637 ..... N78-18808 #
AD-A048647 ..... N78-18760 #
AD-A048651 ..... N78-18004 #
AD-A048653 ..... N78-18637 #
AD-A048654 ..... N78-18279 #
AD-A048655 ..... N78-18226 #
AD-A048657 ..... N78-18192 #
AD-A048659 ..... N78-18140 #
AD-A048662 ..... N78-18416 #
AD-A048665 ..... N78-18663 #
AD-A048666 ..... N78-18399 #
AD-A048667 ..... N78-18160 #
AD-A048669 ..... N78-18191 #
AD-A048670 ..... N78-18022 #
AD-A048673 ..... N78-18576 #
AD-A048674 ..... N78-18971 #
AD-A048675 ..... N78-18100 #
AD-A048677 ..... N78-18005 #
AD-A048684 ..... N78-18778 #
AD-A048686 ..... N78-18638 #
AD-A048687 ..... N78-18464 #
AD-A048688 ..... N78-18280 #
AD-A048691 ..... N78-18367 #
AD-A048722 ..... N78-18023 #
AD-A048723 ..... N78-18666 #
AD-A048730 ..... N78-18665 #
AD-A048741 ..... N78-18877 #
AD-A048744 ..... N78-18467 #
AD-A048745 ..... N78-18912 #
AD-A048746 ..... N78-18218 #
AD-A048749 ..... N78-18368 #
AD-A048750 ..... N78-18579 #
AD-A048751 ..... N78-18336 #
AD-A048752 ..... N78-18612 #
AD-A048753 ..... N78-18887 #
AD-A048756 ..... N78-18199 #
AD-A048757 ..... N78-18578 #
AD-A048764 ..... N78-18420 #
AD-A048765 ..... N78-18782 #
AD-A048767 ..... N78-18433 #
AD-A048769 ..... N78-18283 #
AD-A048771 ..... N78-18194 #
AD-A048772 ..... N78-18195 #
AD-A048773 ..... N78-18196 #
AD-A048779 ..... N78-18419 #
AD-A048780 ..... N78-18898 #
AD-A048781 ..... N78-18330 #
AD-A048784 ..... N78-18768 #
AD-A048786 ..... N78-18872 #
AD-A048789 ..... N78-18972 #
AD-A048791 ..... N78-18853 #
AD-A048801 ..... N78-18282 #

AD-E000071 ..... N78-18368 #
AD-E000072 ..... N78-18579 #
AD-E000073 ..... N78-18336 #
AD-E000080 ..... N78-18612 #
AD-E000082 ..... N78-18887 #
AD-E200039 ..... N78-18324 #
AD-E200075 ..... N78-18330 #
AD-E200076 ..... N78-18419 #
AD-E200077 ..... N78-18898 #
AD-E300042 ..... N78-18272 #
AD-E300071 ..... N78-18282 #
AD-E400010 ..... N78-18199 #
AD-E400020 ..... N78-18577 #
AD-E400023 ..... N78-18578 #
AD-E500004 ..... N78-18861 #
AD-E500005 ..... N78-18332 #

AEDC-TR-77-10321-PT-2 ..... N78-18007 #

AEROCHEM-TN-176 ..... N78-18518*#

AEWES-MP-M-77-14 ..... N78-18503 #

AEWES-MP-71-17-5 ..... N78-18610 #

AFAL-TR-43 ..... N78-18775 #
AFAL-TR-74-351 ..... N78-18031 #
AFAL-TR-76-61-VOL-2 ..... N78-18321 #
AFAL-TR-76-185 ..... N78-18320 #
AFAL-TR-76-221 ..... N78-18029 #
AFAL-TR-77-18 ..... N78-18062 #
AFAL-TR-77-26 ..... N78-18319 #
AFAL-TR-77-34 ..... N78-18776 #
AFAL-TR-77-52 ..... N78-18322 #
AFAL-TR-77-91 ..... N78-18061 #
AFAL-TR-77-110 ..... N78-18064 #
AFAL-TR-77-113 ..... N78-18269 #
AFAL-TR-77-138-VOL-1 ..... N78-18030 #
AFAL-TR-77-151 ..... N78-18095 #
AFAL-TR-77-152 ..... N78-18398 #
AFAL-TR-77-159 ..... N78-18397 #
AFAL-TR-77-167 ..... N78-18065 #
AFAL-TR-77-168 ..... N78-18957 #
AFAL-TR-77-185 ..... N78-18112 #
AFAL-TR-77-203 ..... N78-18907 #
AFAL-TR-77-228 ..... N78-18111 #

AFAPL-TR-77-66 ..... N78-18071 #

AFFDL-TR-77-63 ..... N78-18006 #
AFFDL-TR-77-84 ..... N78-18467 #
AFFDL-TR-77-86 ..... N78-18840 #

AFGL-AFSG-372 ..... N78-18607 #
AFGL-AFSG-373 ..... N78-18608 #

AFGL-ERP-606 ..... N78-19014 #

AFGL-SR-203 ..... N78-18634 #

AFGL-TR-76-0297 ..... N78-18609 #
AFGL-TR-77-0112 ..... N78-18634 #
AFGL-TR-77-0160 ..... N78-19014 #
AFGL-TR-77-0176 ..... N78-18607 #
AFGL-TR-77-0185 ..... N78-18608 #

AFHRL-TR-77-45 ..... N78-18063 #
AFHRL-TR-77-54 ..... N78-18704 #

AFIT-CI-78-12 ..... N78-18632 #

AFIT-GAE/AA/77D-13 ..... N78-18078 #

AFIT-GCS/MA/77-D-3 ..... N78-18846 #
AFIT-GCS/MA/77D-1 ..... N78-18845 #
AFIT-GCS/MA/77D-4 ..... N78-18777 #

AFIT-GEP/PH/77-1 ..... N78-18418 #

AFIT/GEO/PH/77-3 ..... N78-18843 #

AFLCP/AFSCP-1800-19 ..... N78-18965 #

AFML-TR-76-244-PT-2 ..... N78-18140 #
AFML-TR-77-27 ..... N78-18198 #
AFML-TR-77-89 ..... N78-18162 #
AFML-TR-77-90 ..... N78-18138 #
AFML-TR-77-114 ..... N78-18139 #

AFTAC-TR-78-1 ..... N78-18913 #

AFWL-TR-77-89 ..... N78-18324 #
AFWL-TR-77-104 ..... N78-18898 #
AFWL-TR-77-121 ..... N78-18419 #
AFWL-TR-77-152 ..... N78-18330 #

AGARD-AG-231 ..... N78-18046 #
AGARD-AG-233 ..... N78-18770 #

AGARD-AR-92 ..... N78-18051 #
AGARD-AR-112 ..... N78-18374 #

AGARD-LS-94 ..... N78-18375 #

AI-M-304 ..... N78-18778 #

AISR/376 ..... N78-18087 #

AMMRC-CTR-77-29 ..... N78-18443 #

AMMRC-MS-77-9 ..... N78-18216 #

AMMRC-TR-77-17 ..... N78-18214 #
AMMRC-TR-77-19 ..... N78-18159 #
AMMRC-TR-77-21 ..... N78-18465 #

AMRL-TR-77-44 ..... N78-18769 #

AMSAA-TR-187-PT-1 ..... N78-18865 #
AMSAA-TR-187-PT-2 ..... N78-18865 #
AMSAA-TR-210 ..... N78-18844 #

AR-1 ..... N78-18672*#
AR-6 ..... N78-19021*#

ARAP-320 ..... N78-18633 #

ARFR-105 ..... N78-18400 #

ARLCD-TR-77038 ..... N78-18577 #
ARLCD-TR-77040 ..... N78-18199 #
ARLCD-TR-77065 ..... N78-18578 #

ARO-10112.7-E ..... N78-18367 #
ARO-11673.5-E ..... N78-18141 #
ARO-11948.4-MS ..... N78-18189 #
ARO-12048.8-M ..... N78-18850 #
ARO-12233.8-GS ..... N78-18277 #
ARO-12396.6-M ..... N78-18852 #
ARO-13090.2-P ..... N78-18910 #
ARO-13799.1-EX ..... N78-18227 #
ARO-13807.1-PX ..... N78-18417 #
ARO-13916.2-P ..... N78-18611 #

ASO-TEE-2-77 ..... N78-18441 #

ASR78-17 ..... N78-18119*#

ATC-81 ..... N78-18027 #

ATR-1 ..... N78-18420 #
ATR-78(7640)-1 ..... N78-18797*#

AXIOMATIX-R7802-2 ..... N78-18118*#

BERC/OP-76/33 ..... N78-18437 #
BERC/OP-77/3 ..... N78-18438 #
BERC/OP-77/4 ..... N78-18439 #
BERC/OP-77/5 ..... N78-18440 #

BLL-BLRDR-5351 ..... N78-18983 #
BLL-BLRDR-5355-(2113.56F) ..... N78-18982 #
BLL-BLRDR-5396-(2113.56F) ..... N78-18984 #
BLL-BLRDR-5414-(2113.56F) ..... N78-18981 #

BLM-ME-78-14-VOL-1 ..... N78-18506 #
BLM-ME-78-15-VOL-2 ..... N78-18507 #
BLM-ME-78-16-VOL-3 ..... N78-18508 #

BM-MCP-7 ..... N78-18205 #

BMPR-3 ..... N78-18119*#

BMVG-FBWT-77-6 ..... N78-18057 #
BMVG-FBWT-77-7 ..... N78-18010 #
BMVG-FBWT-77-13 ..... N78-18899 #
BMVG-FBWT-77-14 ..... N78-18228 #
BMVG-FBWT-77-15 ..... N78-18013 #
BMVG-FBWT-77-16 ..... N78-18072 #

CADD-7708-0911 ..... N78-18977 #

CALSPAN-XE-5933-A-102 ..... N78-18071 #

CCC-BMD-F77 ..... N78-18093 #

CCS-306 ..... N78-18804 #
CCS-307 ..... N78-18814 #
CCS-313 ..... N78-18805 #

CCVS74-VSR275 ..... N78-18779 #

CEL-TN-1499 ..... N78-18366 #
CEL-TN-1502 ..... N78-18323 #

CGR/DC-18/76-VOL-1 ..... N78-18558*#

CISR-P010-01-05 ..... N78-18782 #

CMR-77-15 ..... N78-18559 #

CR-ISSN-0082-5255 ..... N78-18077 #
CR-ISSN-0082-5255 ..... N78-18556 #

CONF-770434-4 ..... N78-18403 #
CONF-770537-8 ..... N78-18200 #
CONF-770620-1 ..... N78-18079 #
CONF-770653-2 ..... N78-18888 #
CONF-770721-1 ..... N78-18937 #
CONF-770725-1 ..... N78-18938 #
CONF-770801-19 ..... N78-18936 #
CONF-770842-5 ..... N78-18340 #
CONF-770844-3 ..... N78-18404 #

CONS/1011-1 ..... N78-18988*#

COO-2456-46 ..... N78-18942 #

CR-77-588-009 ..... N78-18914 #

CRINC-FRL-266-1 ..... N78-17993*#

CSIR-TR-3 ..... N78-18782 #

C75-787/201-VOL-1 ..... N78-18030 #

DARCOM-P-700-6 ..... N78-18965 #

DATA-66 ..... N78-18664 #

DCIEM-TR-77X45 ..... N78-18876 #

DECC-61098-007 ..... N78-18327 #

DELISG-18-77 ..... N78-18670 #

DHEW/PUB/NIOSH-77/146 ..... N78-18714 #
DHEW/PUB/NIOSH-77/176 ..... N78-18711 #
DHEW/PUB/NIOSH-77/182 ..... N78-18712 #
DHEW/PUB/NIOSH-77/204 ..... N78-18591 #

DLR-FB-77-06 ..... N78-18223 #
DLR-FB-77-07 ..... N78-18203 #
DLR-FB-77-10 ..... N78-18708 #
DLR-FB-77-11 ..... N78-18017 #
DLR-FB-77-12 ..... N78-18018 #
DLR-FB-77-19 ..... N78-18204 #
DLR-FB-77-21 ..... N78-18014 #
DLR-FB-77-24 ..... N78-18408 #
DLR-FB-77-26 ..... N78-18081 #
DLR-FB-77-28 ..... N78-18015 #
DLR-FB-77-31 ..... N78-18222 #
DLR-FB-77-32 ..... N78-18073 #
DLR-FB-77-33 ..... N78-18474 #
DLR-FB-77-35 ..... N78-18016 #
DLR-FB-77-39 ..... N78-18074 #
DLR-FB-77-40 ..... N78-18436 #

DLR-IB-76-3 ..... N78-18110 #
DLR-IB-76-7 ..... N78-18122 #
DLR-IB-151-77/11 ..... N78-18058 #
DLR-IB-152-77/10 ..... N78-18254 #
DLR-IB-152-77/18 ..... N78-18468 #
DLR-IB-257-77/11 ..... N78-18878 #
DLR-IB-353-77/1 ..... N78-18563 #
DLR-IB-456-75/8 ..... N78-18115 #
DLR-IB-456-76/1 ..... N78-18109 #
DLR-IB-456-76/2 ..... N78-18125 #
DLR-IB-456-76/9 ..... N78-18121 #
DLR-IB-456-76/11 ..... N78-18126 #
DLR-IB-456-77/2 ..... N78-18108 #
DLR-IB-456-77/4 ..... N78-18124 #
DLR-IB-456-77/8 ..... N78-18229 #
DLR-IB-456-77/9 ..... N78-18964 #
DLR-IB-456/75-9 ..... N78-18123 #
DLR-IB-456/76-6 ..... N78-18107 #
DLR-IB-536-76/4 ..... N78-18011 #
DLR-IB-536-77/1 ..... N78-18012 #
DLR-IB-551-77/4 ..... N78-18035 #
DLR-IB-551-77/6 ..... N78-18943 #
DLR-IB-551-77/7 ..... N78-18292 #
DLR-IB-552-76/10 ..... N78-18094 #
DLR-IB-552-77/20 ..... N78-18059 #
DLR-IB-553-77/5 ..... N78-18646 #
DLR-IB-553-77/6 ..... N78-18296 #

DLT-FB-77-20 ..... N78-18298 #

DNA-4279T ..... N78-18272 #

DNA-4399F ..... N78-18282 #

DOT-TSC-FAA-77-19 ..... N78-18026 #

DOT-TSC-OST-77-48 ..... N78-18437 #
DOT-TSC-OST-77-49 ..... N78-18438 #
DOT-TSC-OST-77-50 ..... N78-18439 #
DOT-TSC-OST-77-51 ..... N78-18440 #

DOT-TSC-UMTA-77-30-1-VOL-1 ..... N78-18034 #
DOT-TSC-UMTA-77-30-2-APP ..... N78-18039 #

DR-943 ..... N78-18640 #
DR-947 ..... N78-18642 #
DR-948 ..... N78-18639 #
DR-950 ..... N78-18643 #

DSL-TR-147 ..... N78-18808 #

DTNSRDC-77-0065 ..... N78-18001 #
DTNSRDC-77-0102 ..... N78-18433 #

DTNSRDC/ASED-390 ..... N78-18002 #

DYTEC-R-7708 ..... N78-18874*#

D210-11225-1 ..... N78-18054 #

E-9265 ..... N78-18429*#
E-9283 ..... N78-17998*#
E-9308 ..... N78-18988*#

ECAC-PR-77-037 ..... N78-18032 #

ECE-77-7 ..... N78-18787 #
ECE-77-8 ..... N78-18788 #

ECOM-77-6 ..... N78-18636 #
ECOM-4542-PT-2 ..... N78-18274 #
ECOM-4544 ..... N78-18326 #
ECOM-4547-PT-3 ..... N78-18273 #
ECOM-4548 ..... N78-18958 #
ECOM-4551 ..... N78-18268 #

EPA-340/1-77-024 ..... N78-18581 #
EPA-450/2-77-023 ..... N78-18598 #
EPA-450/2-77-027 ..... N78-18582 #
EPA-450/3-77-003C ..... N78-18593 #
EPA-450/3-77-022-A-VOL-1 ..... N78-18618 #
EPA-450/3-77-044 ..... N78-18566 #
EPA-460/3-77-006 ..... N78-18163 #
EPA-460/3-77-013 ..... N78-18580 #
EPA-460/3-77-014 ..... N78-18597 #
EPA-520/1-77-009 ..... N78-18710 #
EPA-560/9-77-001 ..... N78-18129 #
EPA-600/1-77-034 ..... N78-18713 #
EPA-600/1-77-041 ..... N78-18585 #
EPA-600/1-77-045 ..... N78-18675 #
EPA-600/2-77-206 ..... N78-18565 #
EPA-600/2-77-209A ..... N78-18589 #
EPA-600/2-77-210 ..... N78-18992 #
EPA-600/2-77-211 ..... N78-18999 #
EPA-600/3-77-110 ..... N78-18586 #
EPA-600/3-77-123 ..... N78-18599 #
EPA-600/4-77-046 ..... N78-18588 #
EPA-600/7-77-073D-VOL-4 ..... N78-18584 #
EPA-600/7-77-073E ..... N78-18590 #
EPA-600/7-77-095B ..... N78-18596 #
EPA-600/9-77-013 ..... N78-18587 #

ERDA/JPL-954363-77/1 ..... N78-18516*#
ERDA/JPL-954506-77/3 ..... N78-18517*#
ERDA/JPL-954560-77/4 ..... N78-18518*#
ERDA/JPL-954606-77/2 ..... N78-18519*#

ERIM-122400-9-F ..... N78-18064 #
ERIM-300100-4-F ..... N78-18487*#

ESA-CR(P)-968 ..... N78-18114 #
ESA-CR(P)-977-VOL-2-APP-5-7 ..... N78-18505 #
ESA-CR(P)-1008 ..... N78-18916 #
ESA-CR(P)-1009 ..... N78-18979 #
ESA-CR(P)-1012 ..... N78-18563 #
ESA-CR(P)-1013 ..... N78-18405 #

ESA-PSS-07/QRH-01-ISSUE-3 ..... N78-18116 #
ESA-PSS-37/QRH-06T-ISSUE-1 ..... N78-18444 #

ESA-SP-1006 ..... N78-18102 #

ESA-TM-178 ..... N78-18862 #

ESA-TT-417 ..... N78-18223 #
ESA-TT-418 ..... N78-18203 #
ESA-TT-420 ..... N78-18708 #
ESA-TT-421 ..... N78-18017 #
ESA-TT-426 ..... N78-18018 #
ESA-TT-433 ..... N78-18408 #
ESA-TT-434 ..... N78-18081 #
ESA-TT-437 ..... N78-18204 #
ESA-TT-438 ..... N78-18298 #
ESA-TT-441 ..... N78-18341 #

ESD-TR-77-175 ..... N78-18099 #
ESD-TR-77-259-VOL-1 ..... N78-18806 #
ESD-TR-77-263 ..... N78-18807 #
ESD-TR-77-266 ..... N78-18466 #
ESD-TR-77-272 ..... N78-18911 #
ESD-TR-77-274 ..... N78-18113 #
ESD-TR-77-275 ..... N78-18912 #

ESL-IR-740 ..... N78-18434 #
ESL-IR-771 ..... N78-18435 #

ESL-784575-1 ..... N78-18279 #

ETL-0120 ..... N78-18399 #

ETS-20 ..... N78-18912 #
ETS-24 ..... N78-18113 #

E78-10073 ..... N78-18482*#
E78-10074 ..... N78-18483*#
E78-10075 ..... N78-18484*#
E78-10076 ..... N78-18485*#
E78-10077 ..... N78-18486*#
E78-10078 ..... N78-18487*#
E78-10079 ..... N78-18488*#
E78-10080 ..... N78-18489*#

FAA-ED-15-2A ..... N78-18629 #

FAA-EM-77-10 ..... N78-18026 #

FAA-NA-77-29 ..... N78-18260 #
FAA-NA-77-41 ..... N78-18021 #

FAA-RD-77-4 ..... N78-18069 #
FAA-RD-77-18 ..... N78-18260 #
FAA-RD-77-47 ..... N78-18158 #
FAA-RD-77-134 ..... N78-18027 #
FAA-RD-77-140 ..... N78-18032 #
FAA-RD-77-145 ..... N78-18641 #
FAA-RD-77-153 ..... N78-18264 #
FAA-RD-77-169 ..... N78-18021 #

FCC/OCE/RS77-03 ..... N78-18879 #

FCVS66-VSR260 ..... N78-18781 #
FCVS66-VSR265 ..... N78-18780 #

FEA/S-77/359 ..... N78-18564 #

FF-12 ..... N78-18399 #

FFA-MEMO-114 ..... N78-18372 #

FFM-246 ..... N78-18816 #
FFM-247 ..... N78-18293 #
FFM-248 ..... N78-18294 #
FFM-257 ..... N78-18295 #

FHWA-CA-TL-6571-77-12 ..... N78-18445 #

FIRL-C-4735-01-VOL-2 ..... N78-18705 #

FR-9232 ..... N78-18070*#

FSU-STATISTICS-M440 ..... N78-18638 #

FTD-ID(RS)T-1069-77 ..... N78-18885 #
FTD-ID(RS)T-1081-77 ..... N78-18827 #
FTD-ID(RS)T-1156-77 ..... N78-18637 #
FTD-ID(RS)T-1237-77 ..... N78-18003 #
FTD-ID(RS)T-1238-77 ..... N78-18004 #

FU15-4-VOL-2-APP-5-7 ..... N78-18505 #

GCA-TR-76-6-G(3) ..... N78-18593 #

GPO-99-072 ..... N78-18106 #

GSFC/LN-77/013A ..... N78-18509*#
GSFC/LU-77/013A ..... N78-18510*#

G7702-F-9 ..... N78-18673*#

H-922 ..... N78-18076*#
H-1008 ..... N78-18042*#

HAC-P76-527R ..... N78-18062 #
HAC-P77-157R-PT-2 ..... N78-18800 #
HAC-P77-189 ..... N78-18269 #
HAC-P77-380 ..... N78-18333 #

HAC-REF-C9383 ..... N78-18062 #

HAC-REF-D5676 ..... N78-18269 #

HAE-REF-D4846 ..... N78-18333 #

HCP/L4965-0001 ..... N78-18562 #

HDL-TM-77-30 ..... N78-18276 #
HDL-TM-77-32 ..... N78-18329 #

HDL-TR-1832 ..... N78-18288 #

HEL-TM-30-77 ..... N78-18768 #

HUD-RES-1175 ..... N78-18994 #
HUD-RES-1181 ..... N78-18995 #
HUD-RES-1182 ..... N78-18996 #
HUD-RES-1183 ..... N78-18997 #
HUD-RES-1187 ..... N78-18990 #

IBM-77W-0061 ..... N78-18527*#

IBR-77-22 ..... N78-18985 #

IDA/HQ-77-19316 ..... N78-18332 #

IG-PUBL-597 ..... N78-18583 #

IIASA-RM-77-21 ..... N78-18810 #

INMR29-PD18-77 ..... N78-18560 #

IMS-DATA PUB-2 ..... N78-18615 #

IPPJ-312 ..... N78-18928 #
IPPJ-313 ..... N78-18929 #
IPPJ-314 ..... N78-18930 #
IPPJ-315 ..... N78-18931 #
IPPJ-316 ..... N78-18932 #
IPPJ-317 ..... N78-18933 #
IPPJ-318 ..... N78-18934 #
IPPJ-319 ..... N78-18935 #

IPR-1 ..... N78-18434 #
IPR-2 ..... N78-18435 #

IRI-190-77-01 ..... N78-18709 #

IRT-8151-003 ..... N78-18317 #

ISBN-0-669-01441-9 ..... N78-18568 #
ISBN-0-903154-08 ..... N78-18981 #
ISBN-0-905984-03-X ..... N78-18983 #
ISBN-0-9503801-3-X ..... N78-18984 #
ISBN-92-63-10469-7 ..... N78-18651 #
ISBN-92-63-10471-9 ..... N78-18645 #
ISBN-92-63-10476-X ..... N78-18652 #
ISBN-92-63-10489-1 ..... N78-18644 #
ISBN-92-835-74-X ..... N78-18770 #
ISBN-92-835-0210-8 ..... N78-18375 #
ISBN-92-835-1271-5 ..... N78-18046 #

ISI/RR-77-63 ..... N78-18802 #
ISI/RR-77-64 ..... N78-18825 #

ISS-P-76/9 ..... N78-18706 #
ISS-P-76/10 ..... N78-18425 #

ISS-R-76/7-PT-1 ..... N78-18891 #
ISS-R-76/8-PT-2 ..... N78-18892 #

ISS-T-76/6 ..... N78-18344 #
ISS-T-77/1 ..... N78-18889 #

ITR-1 ..... N78-18776 #

JPL-PUB-77-43 ..... N78-18495*#
JPL-PUB-77-63 ..... N78-18528*#
JPL-PUB-77-69 ..... N78-18897*#
JPL-PUB-77-80 ..... N78-18702*#

JPL-5040-27-VOL-1 ..... N78-18558*#

JPRS-69380 ..... N78-18715 #
JPRS-69964 ..... N78-18738 #
JPRS-70135 ..... N78-18679 #

JSC-78-FM-3 ..... N78-18104*#
JSC-12992 ..... N78-19020*#
JSC-13838 ..... N78-18104*#

JWTR-1 ..... N78-18194 #
JWTR-2 ..... N78-18195 #
JWTR-3 ..... N78-18196 #

KWMI-V-290 ..... N78-18648 #

KWMI-WR-77-5 ..... N78-18669 #
KWMI-WR-77-6 ..... N78-18647 #

L-10640-PT-1 ..... N78-18133*#
L-10640-PT-2 ..... N78-18134*#
L-11465 ..... N78-18358*#
L-11705 ..... N78-17997*#
L-11770 ..... N78-18362*#
L-11864 ..... N78-18135*#
L-11869 ..... N78-18823*#
L-11909 ..... N78-18459*#
L-11913 ..... N78-18572*#
L-11926 ..... N78-18263*#
L-11944 ..... N78-18363*#
L-11957 ..... N78-18796*#
L-11960 ..... N78-18044*#
L-11968 ..... N78-18252*#

LA-UR-77-1523 ..... N78-18936 #
LA-UR-77-1790 ..... N78-18404 #

LABS-PUB-110577 ..... N78-18493*#

LBL-6275 ..... N78-18888 #

LC-62-37059 ..... N78-18169 #
LC-76-608384 ..... N78-18128 #
LC-77-2049 ..... N78-18568 #
LC-77-25245 ..... N78-18345 #
LC-77-622654 ..... N78-18592 #

LCR-450/258 ..... N78-18343 #

LDTP-77-6 ..... N78-18594 #

LEC-10830 ..... N78-18484*#
LEC-11354 ..... N78-18496*#
LEC-11680 ..... N78-18624*#

LETI/EPA/CRH-1248 ..... N78-18405 #

LMSC-D564116 ..... N78-18251*#
LMSC-D564369 ..... N78-18461 #

LMSC-HREC-TR-D568188 ..... N78-18520*#

LYCEN-7705 ..... N78-18342 #
LYCEN-7719 ..... N78-18167 #

M-245 ..... N78-18573*#
M-248 ..... N78-18497*#

MDC-Q0634 ..... N78-18421 #

MERADCOM-2220 ..... N78-18226 #

MIMEO-SER-514 ..... N78-18860 #

MIT-LCS-TR-188 ..... N78-18783 #

MITSG-77-20 ..... N78-18986 #

MTI-78TR17 ..... N78-18460*#

MTR-3294-VOL-1 ..... N78-18806 #
MTR-6951-VOL-2 ..... N78-18037 #
MTR-7047 ..... N78-18038 #
MTR-7115-REV-1 ..... N78-18036 #

M72-27 ..... N78-19000 #

NA-77-180 ..... N78-18158 #

NADC-76105-30 ..... N78-18008 #
NADC-77252-30 ..... N78-18188 #
NADC-77259-30 ..... N78-18333 #
NADC-77289-60 ..... N78-18767 #

NASA-CASE-ARC-10903-1 ..... N78-18083*
NASA-CASE-ARC-11058-2 ..... N78-18763*#

NASA-CASE-FRC-10090-1 ..... N78-18308*
NASA-CASE-FRC-10093-1 ..... N78-18393*#

NASA-CASE-GSC-12010-1 ..... N78-18905*
NASA-CASE-GSC-12171-1 ..... N78-18313*#

NASA-CASE-LAR-11688-1 ..... N78-18045*#
NASA-CASE-LAR-11999-1 ..... N78-18394*#
NASA-CASE-LAR-12259-1 ..... N78-18762*#

NASA-CASE-LEW-12095-1 ..... N78-18182*
NASA-CASE-LEW-12389-2 ..... N78-18066*
NASA-CASE-LEW-12554-1 ..... N78-18355*
NASA-CASE-LEW-12905-1 ..... N78-18183*
NASA-CASE-LEW-12917-1 ..... N78-18067*

NASA-CASE-MFS-23008-1 ..... N78-18390*

NASA-CASE-MSC-10954-1 ..... N78-18761*
NASA-CASE-MSC-16260-1 ..... N78-18674*#

NASA-CASE-NPO-13687-1 ..... N78-18391*
NASA-CASE-NPO-13801-1 ..... N78-18410*
NASA-CASE-NPO-13999-1 ..... N78-18395*#
NASA-CASE-NPO-14035-1 ..... N78-18266*#
NASA-CASE-NPO-14174-1 ..... N78-18396*#
NASA-CASE-NPO-14383-1 ..... N78-18253*#

NASA-CP-2026 ..... N78-18088*#

NASA-CR-2916 ..... N78-18822*#
NASA-CR-2919 ..... N78-18662*#
NASA-CR-2945 ..... N78-18573*#
NASA-CR-2946 ..... N78-18000*#
NASA-CR-2950 ..... N78-18458*#
NASA-CR-2956 ..... N78-19022*#
NASA-CR-15571 ..... N78-18068*#
NASA-CR-135129 ..... N78-18411*#
NASA-CR-135238 ..... N78-17991*#
NASA-CR-135252 ..... N78-18070*#
NASA-CR-135311 ..... N78-18672*#
NASA-CR-135316 ..... N78-18515*#
NASA-CR-135328 ..... N78-18460*#
NASA-CR-135342 ..... N78-18251*#
NASA-CR-135343 ..... N78-18131*#
NASA-CR-135353 ..... N78-18883*#
NASA-CR-141434 ..... N78-18798*#
NASA-CR-141435 ..... N78-18661*#
NASA-CR-145288 ..... N78-17990*#
NASA-CR-145290 ..... N78-18359*#
NASA-CR-145298 ..... N78-18797*#
NASA-CR-145302 ..... N78-18874*#
NASA-CR-145304 ..... N78-17993*#
NASA-CR-145305 ..... N78-18086*#
NASA-CR-145306 ..... N78-17994*#
NASA-CR-145307 ..... N78-18028*#
NASA-CR-150506 ..... N78-18525*#
NASA-CR-150511 ..... N78-18521*#
NASA-CR-150515 ..... N78-18526*#
NASA-CR-150516 ..... N78-18522*#
NASA-CR-150522 ..... N78-18527*#
NASA-CR-150524 ..... N78-18523*#
NASA-CR-150533 ..... N78-18524*#
NASA-CR-150541 ..... N78-18623*#
NASA-CR-150546 ..... N78-18098*#
NASA-CR-150547 ..... N78-18625*#
NASA-CR-150548 ..... N78-18261*#
NASA-CR-150549 ..... N78-18626*#
NASA-CR-150550 ..... N78-18627*#

NASA-CR-150551 ..... N78-18628*#
NASA-CR-150552 ..... N78-18262*#
NASA-CR-150562 ..... N78-18119*#
NASA-CR-150563 ..... N78-18520*#
NASA-CR-151600 ..... N78-18096*#
NASA-CR-151615 ..... N78-18485*#
NASA-CR-151616 ..... N78-18624*#
NASA-CR-151617 ..... N78-18484*#
NASA-CR-151618 ..... N78-19021*#
NASA-CR-151620 ..... N78-18259*#
NASA-CR-151624 ..... N78-18487*#
NASA-CR-151627 ..... N78-18496*#
NASA-CR-151628 ..... N78-18212*#
NASA-CR-151634 ..... N78-18118*#
NASA-CR-151636 ..... N78-18493*#
NASA-CR-151637 ..... N78-18871*#
NASA-CR-151638 ..... N78-18700*#
NASA-CR-151639 ..... N78-18494*#
NASA-CR-155305 ..... N78-19013*#
NASA-CR-155307 ..... N78-18701*#
NASA-CR-155308 ..... N78-18120*#
NASA-CR-155310 ..... N78-19016*#
NASA-CR-155313 ..... N78-18897*#
NASA-CR-155363 ..... N78-18024*#
NASA-CR-155718 ..... N78-18482*#
NASA-CR-155731 ..... N78-18486*#
NASA-CR-155741 ..... N78-18488*#
NASA-CR-155742 ..... N78-18489*#
NASA-CR-155743 ..... N78-18168*#
NASA-CR-155746 ..... N78-18275*#
NASA-CR-155766 ..... N78-17995*#
NASA-CR-155769 ..... N78-18499*#
NASA-CR-155770 ..... N78-18224*#
NASA-CR-155774 ..... N78-18884*#
NASA-CR-155775 ..... N78-19025*#
NASA-CR-155778 ..... N78-18500*#
NASA-CR-155779 ..... N78-17996*#
NASA-CR-155780 ..... N78-18495*#
NASA-CR-155781 ..... N78-18702*#
NASA-CR-155782 ..... N78-18528*#
NASA-CR-155783 ..... N78-18678*#
NASA-CR-155785 ..... N78-18132*#
NASA-CR-155786 ..... N78-18090*#
NASA-CR-155932 ..... N78-18519*#
NASA-CR-155933 ..... N78-18518*#
NASA-CR-155934 ..... N78-18517*#
NASA-CR-155935 ..... N78-18516*#
NASA-CR-156686 ..... N78-18483*#

NASA-NEWS-RELEASE-78-22 ..... N78-18480*

NASA-SP-419 ..... N78-18771*#
NASA-SP-5104 ..... N78-18312*#
NASA-SP-7011 (175) ..... N78-18677*+
NASA-SP-7037 (91) ..... N78-17989*+
NASA-SP-7041 (15) ..... N78-18481*+

NASA-TM-X-3377-PT-1 ..... N78-18133*#
NASA-TM-X-3377-PT-2 ..... N78-18134*#
NASA-TM-X-64755-REV-A ..... N78-18311*#

NASA-TM-69366 ..... N78-18265*#
NASA-TM-72851 ..... N78-18075*#
NASA-TM-72853 ..... N78-18042*#
NASA-TM-73223 ..... N78-18025*#
NASA-TM-73756 ..... N78-18988*#
NASA-TM-74040 ..... N78-18084*#
NASA-TM-74091 ..... N78-18358*#
NASA-TM-74978 ..... N78-18498*#
NASA-TM-75058 ..... N78-18097*#
NASA-TM-75063 ..... N78-18041*#
NASA-TM-75064 ..... N78-18490*#
NASA-TM-75065 ..... N78-18491*#
NASA-TM-75075 ..... N78-18699*#
NASA-TM-75078 ..... N78-18989*#
NASA-TM-75081 ..... N78-18492*#
NASA-TM-75083 ..... N78-19012*#
NASA-TM-75148 ..... N78-18357*#
NASA-TM-75174 ..... N78-18089*#
NASA-TM-75178 ..... N78-18953*#
NASA-TM-75231 ..... N78-18927*#
NASA-TM-75246 ..... N78-18392 #
NASA-TM-75249 ..... N78-18309*#
NASA-TM-75255 ..... N78-18307*
NASA-TM-75256 ..... N78-18310*#
NASA-TM-78154 ..... N78-18213*#
NASA-TM-78156 ..... N78-18092*#
NASA-TM-78458 ..... N78-18127*#
NASA-TM-78459 ..... N78-18043*#
NASA-TM-78630 ..... N78-18572*#
NASA-TM-78631 ..... N78-18263*#
NASA-TM-78633 ..... N78-18796*#
NASA-TM-78648 ..... N78-18085*#
NASA-TM-78659 ..... N78-17992*#
NASA-TM-78660 ..... N78-18873*#
NASA-TM-78662 ..... N78-18117*#
NASA-TM-78668 ..... N78-18105*#
NASA-TM-79326 ..... N78-18975*#
NASA-TM-79348 ..... N78-19020*#
NASA-TM-79349 ..... N78-18104*#
NASA-TM-79350 ..... N78-19026*#
NASA-TM-79358 ..... N78-18510*#
NASA-TM-79359 ..... N78-18509*#
NASA-TM-79360 ..... N78-18091*#
NASA-TM-79361 ..... N78-18976*#
NASA-TM-79383 ..... N78-18882*#

NASA-TP-1017 ..... N78-18630*#
NASA-TP-1075 ..... N78-18362*#
NASA-TP-1117 ..... N78-18135*#
NASA-TP-1118 ..... N78-18823*#
NASA-TP-1119 ..... N78-17997*#
NASA-TP-1130 ..... N78-18429*#
NASA-TP-1132 ..... N78-17998*#
NASA-TP-1133 ..... N78-18363*#
NASA-TP-1135 ..... N78-18044*#
NASA-TP-1137 ..... N78-18459*#
NASA-TP-1142 ..... N78-18252*#
NASA-TP-1148 ..... N78-18076*#
NASA-TP-1153 ..... N78-17999*#
NASA-TP-1155 ..... N78-18364*#
NASA-TP-1164 ..... N78-18497*#
NASA-TP-1165 ..... N78-18673*#

NASA-TT-F-17159 ..... N78-18795*#

NAVMAT-P5242 ..... N78-18965 #

NAVTRAEQUIPC-74-C-0141-1 ..... N78-18087 #

NBS-SP-400-41 ..... N78-18345 #
NBS-SP-464 ..... N78-18128 #

NBS-TN-696-REV ..... N78-18287 #
NBS-TN-956 ..... N78-18811 #
NBS-TN-958 ..... N78-18785 #

NBSIR-75-939 ..... N78-18256 #
NBSIR-76-1088 ..... N78-18655 #
NBSIR-77-859 ..... N78-18168*#
NBSIR-77-866 ..... N78-18402 #
NBSIR-77-868 ..... N78-18339 #
NBSIR-77-1394 ..... N78-18370 #
NBSIR-77/12 ..... N78-18567 #

NEAR-TR-155 ..... N78-18365 #

NEPRF-TR-77-01 ..... N78-18635 #

NLR-MP-76023-U ..... N78-18289 #
NLR-MP-77012-U ..... N78-18019 #
NLR-MP-77015-U ..... N78-18080 #

NLR-TR-75115-U ..... N78-18009 #
NLR-TR-75165-U ..... N78-18475 #
NLR-TR-76086-U ..... N78-18371 #
NLR-TR-76133-U ..... N78-18056 #

NOAA-TM-ERL-WPL-26 ..... N78-18656 #

NOAA-TM-NWS-SR-93 ..... N78-18657 #

NOAA-TR-NOS-72-NGS-7 ..... N78-18617 #

NOAA-77092106 ..... N78-18667 #
NOAA-77101212 ..... N78-18617 #
NOAA-77101302 ..... N78-18024*#
NOAA-77101719-PT-1 ..... N78-19023 #
NOAA-77101720-PT-2 ..... N78-19024 #
NOAA-77101721 ..... N78-18615 #
NOAA-77101904 ..... N78-18986 #
NOAA-77110312 ..... N78-18671 #
NOAA-77110404 ..... N78-18657 #
NOAA-77110405 ..... N78-18619 #
NOAA-77110409 ..... N78-18670 #
NOAA-77110802 ..... N78-18656 #

NOO-TM-3700-67-77 ..... N78-18665 #

NOSC-TR-142 ..... N78-18281 #
NOSC-TR-146 ..... N78-18283 #
NOSC-TR-153 ..... N78-18267 #
NOSC-TR-165 ..... N78-18909 #

NPL-CHEM-74 ..... N78-18165 #
NPL-CHEM-76 ..... N78-18166 #

NPL-COM-86 ..... N78-18980 #
NPL-COM-87 ..... N78-18297 #
NPL-COM-88 ..... N78-18809 #
NPL-COM-89 ..... N78-18817 #

NPL-DMA-246 ..... N78-18202 #

NPL-MOM-25 ..... N78-18921 #

NPL-NAC-81 ..... N78-18786 #

NPL-QU-AR75 ..... N78-18973 #

NPL-QU-40 ..... N78-18424 #
NPL-QU-41 ..... N78-18406 #
NPL-QU-42 ..... N78-18407 #

NPS-67BI77111 ..... N78-18415 #
NPS-67SX77111 ..... N78-18005 #
NPS-69PS77004 ..... N78-18186 #

NRL-MR-3650 ..... N78-18612 #
NRL-MR-3651 ..... N78-18368 #
NRL-MR-3658 ..... N78-18887 #
NRL-MR-3670 ..... N78-18336 #

NSF/IDOE-77/161 ..... N78-18668 #
NSF/RA-770273 ..... N78-18568 #
NSF/RA-770285 ..... N78-18991 #

NSSL-1 ..... N78-18641 #

NST-10 ..... N78-18976*#

NSWC/DL-TR-3744 ..... N78-18192 #
NSWC/WOL-TR-77-144 ..... N78-18325 #
NSWC/WOL/TR-77-96 ..... N78-18225 #

NTISUB/C/138-013A ..... N78-18510*#
NTISUB/C/139-013A ..... N78-18509*#

NUSC-TD-4498 ..... N78-18978 #
NUSC-TD-4723 ..... N78-18978 #
NUSC-TD-5699 ..... N78-18278 #

NUSC-TR-5775 ..... N78-18286 #

NUSC/NL-TD-5329 ..... N78-18978 #

NWC-TP-5983 ..... N78-18136 #
NWC-TP-5996 ..... N78-18765 #

NYSERDA-75/34 ..... N78-18561 #

N77 ..... N78-18859 #
N84 ..... N78-18803 #
N85 ..... N78-18848 #
N86 ..... N78-18847 #
N87 ..... N78-18851 #
N88 ..... N78-18849 #
N89 ..... N78-18842 #
N93 ..... N78-18801 #
N00014-0860/4 ..... N78-18464 #

OAQPS-1.2-084 ..... N78-18582 #

OHR-11 ..... N78-18652 #

ONR-TR-126 ..... N78-18638 #

ORSER-SSEL-TR-4-76 ..... N78-18483*#

OT-TM-77-242 ..... N78-18277 #

OT/ITS-910 ..... N78-18277 #

OTR-77-128 ..... N78-18299 #

OUEL-1183/77-PT-1 ..... N78-18917 #
OUEL-1184/77-PT-2 ..... N78-18918 #
OUEL-1185/77-PT-3 ..... N78-18919 #
OUEL-1187/77 ..... N78-18469 #
OUEL-1189/77 ..... N78-18993 #
OUEL-1195/77 ..... N78-18255 #
OUEL-1199/77 ..... N78-18470 #
OUEL-1206/77-VOL-1 ..... N78-18471 #
OUEL-1209/77 ..... N78-18472 #
OUEL-1210/77-VOL-2 ..... N78-18473 #
OUEL-1216/77 ..... N78-18373 #
OUEL-1220/77 ..... N78-18920 #

OWRT/WRSIC-77/203-VOL-2 ..... N78-19002 #

P-7133 ..... N78-18858 #

PAQPS-1-2-049 ..... N78-18598 #

PAR-77-27 ..... N78-18824 #

PA100-77-31 ..... N78-18033 #

PB-273474/7 ..... N78-18564 #
PB-273700/5 ..... N78-18506 #
PB-273701/3 ..... N78-18507 #
PB-273702/1 ..... N78-18508 #
PB-273899/5 ..... N78-18567 #
PB-273949/8 ..... N78-18655 #
PB-274011/6 ..... N78-18675 #
PB-274015/7 ..... N78-18504 #
PB-274029/8 ..... N78-18584 #
PB-274031/4 ..... N78-18667 #
PB-274055/3 ..... N78-18585 #
PB-274070/2 ..... N78-18205 #
PB-274093/4 ..... N78-18998 #
PB-274113/0 ..... N78-18565 #
PB-274123/9 ..... N78-18568 #
PB-274177/5 ..... N78-18994 #
PB-274178/3 ..... N78-18995 #
PB-274179/1 ..... N78-18996 #
PB-274180/9 ..... N78-18997 #
PB-274186/6 ..... N78-18168*#
PB-274207/0 ..... N78-18990 #
PB-274218/7 ..... N78-18714 #
PB-274220/3 ..... N78-18562 #
PB-274229/4 ..... N78-18710 #
PB-274259/1 ..... N78-18991 #
PB-274278/1 ..... N78-18511 #
PB-274368/0 ..... N78-18599 #
PB-274374/8 ..... N78-18437 #
PB-274375/5 ..... N78-18438 #
PB-274376/3 ..... N78-18439 #
PB-274377/1 ..... N78-18440 #
PB-274398/7 ..... N78-19003 #
PB-274406/8 ..... N78-18560 #
PB-274411/8 ..... N78-19001 #
PB-274440/7 ..... N78-19002 #
PB-274442/3 ..... N78-18668 #
PB-274449/8 ..... N78-18589 #
PB-274452/2 ..... N78-18588 #
PB-274453/0 ..... N78-18785 #
PB-274456/3 ..... N78-18402 #
PB-274457/1 ..... N78-18339 #
PB-274458/9 ..... N78-18299 #
PB-274493/6 ..... N78-18592 #
PB-274495/1 ..... N78-18445 #
PB-274527/1 ..... N78-18593 #
PB-274529/7 ..... N78-18658 #
PB-274530/5 ..... N78-18586 #
PB-274532/1 ..... N78-18787 #
PB-274533/9 ..... N78-18788 #
PB-274535/4 ..... N78-19004 #
PB-274539/6 ..... N78-18434 #
PB-274540/4 ..... N78-18435 #
PB-274541/2 ..... N78-18587 #
PB-274547/9 ..... N78-18597 #
PB-274578/4 ..... N78-18036 #
PB-274585/9 ..... N78-18037 #
PB-274587/5 ..... N78-19000 #
PB-274590/9 ..... N78-18038 #
PB-274599/0 ..... N78-18163 #
PB-274618/8 ..... N78-19005 #
PB-274643/6 ..... N78-18256 #
PB-274650/1 ..... N78-18370 #
PB-274698/0 ..... N78-18617 #
PB-274750/9 ..... N78-18591 #
PB-274776/4 ..... N78-18711 #
PB-274793/9 ..... N78-18712 #
PB-274823/4 ..... N78-19023 #
PB-274824/2 ..... N78-19024 #

PB-274859/8 ..... N78-18999 #
PB-274861/4 ..... N78-18598 #
PB-274865/5 ..... N78-18594 #
PB-274874/7 ..... N78-18992 #
PB-274887/9 ..... N78-18879 #
PB-274895/2 ..... N78-18811 #
PB-274897/8 ..... N78-18590 #
PB-274902/6 ..... N78-18580 #
PB-274922/4 ..... N78-18596 #
PB-274938/0 ..... N78-18287 #
PB-274939/8 ..... N78-18345 #
PB-274955/4 ..... N78-18034 #
PB-274956/2 ..... N78-18039 #
PB-274965/3 ..... N78-18713 #
PB-275000/8 ..... N78-18566 #
PB-275001/6 ..... N78-18618 #
PB-275005/7 ..... N78-18581 #
PB-275008/1 ..... N78-18128 #
PB-275037/0 ..... N78-18169 #
PB-275042/0 ..... N78-18561 #
PB-275053/7 ..... N78-18582 #
PB-275067/7 ..... N78-18595 #
PB-275090/9 ..... N78-18024*#
PB-275095/8 ..... N78-18615 #
PB-275096/6 ..... N78-18614 #
PB-275106/3 ..... N78-18129 #
PB-275184/0 ..... N78-18657 #
PB-275212/9 ..... N78-18619 #
PB-275247/5 ..... N78-18671 #
PB-275317/6 ..... N78-18670 #
PB-275346/5 ..... N78-18656 #
PB-275353/1 ..... N78-18986 #

PH/77/6 ..... N78-18890 #

POLY-M/AE-78-6 ..... N78-17996*#

PPPL-1346-PT-2 ..... N78-18939 #
PPPL-1352 ..... N78-18940 #
PPPL-1358 ..... N78-18941 #

PR-1 ..... N78-18908 #
PR-4 ..... N78-18005 #
PR-6 ..... N78-18413 #

PRC/DSC-606-ADD-B ..... N78-18784 #

PSU/TURBO-R78-1 ..... N78-17995*#

PWA-5516 ..... N78-17991*#

P78-10026 ..... N78-18480*

QPR-2 ..... N78-18416 #
QPR-3 ..... N78-18331 #

QR-2 ..... N78-18519*#
QR-2 ..... N78-18886 #
QR-4 ..... N78-18315 #
QR-4 ..... N78-18518*#
QR-5 ..... N78-18517*#

QSR-1 ..... N78-18961 #

R-1087 ..... N78-18065 #
R-1089 ..... N78-18397 #

RADC-TR-76-224-VOL-1 ..... N78-18824 #
RADC-TR-76-224-VOL-2 ..... N78-18824 #
RADC-TR-76-224-VOL-3 ..... N78-18824 #
RADC-TR-77-153 ..... N78-18401 #
RADC-TR-77-219 ..... N78-18317 #
RADC-TR-77-296 ..... N78-18337 #
RADC-TR-77-302-PT-2 ..... N78-18800 #
RADC-TR-77-311 ..... N78-18328 #
RADC-TR-77-332 ..... N78-18557 #
RADC-TR-77-339 ..... N78-18338 #
RADC-TR-77-340-VOL-1 ..... N78-18501 #
RADC-TR-77-340-VOL-2 ..... N78-18502 #
RADC-TR-77-344 ..... N78-18316 #
RADC-TR-77-349 ..... N78-18824 #
RADC-TR-77-355 ..... N78-18271 #

RDA-TR-140801-008 ..... N78-18272 #

RD177R4001 ..... N78-18212*#

REC-ERC-77-8 ..... N78-18658 #

REPT-1 ..... N78-18873*#
REPT-5 ..... N78-18610 #
REPT-10 ..... N78-18439 #
REPT-11 ..... N78-18440 #
REPT-27 ..... N78-18217 #
REPT-67 ..... N78-18871*#
REPT-76W-0128-REV ..... N78-18524*#
REPT-77-26 ..... N78-18959 #
REPT-77-042 ..... N78-18623*#
REPT-77-0043 ..... N78-18321 #
REPT-0877-1393-VOL-1 ..... N78-18335 #
REPT-0877-1397-VOL-2 ..... N78-18334 #
REPT-1266-R-0007 ..... N78-18319 #
REPT-1432-2 ..... N78-18432 #
REPT-2258/4 ..... N78-18516*#
REPT-5341-427 ..... N78-18431 #

RH-606 ..... N78-18592 #
RH-646 ..... N78-18854 #
RH-648 ..... N78-18157 #

RR-77-7 ..... N78-19005 #
RR-407 ..... N78-18970 #

RRA-T7704 ..... N78-18913 #

RSC-3273 ..... N78-18482*#
RSC-3337 ..... N78-18494*#

RTI-4378-1009-F ..... N78-18028*#

R7801-3 ..... N78-18259*#

S-481 ..... N78-18364*#
S-2284 ..... N78-18101 #

S/IS-7710 ..... N78-18877 #

SAI-78-567-WA ..... N78-18875 #

SAMSO-TR-77-146 ..... N78-18161 #
SAMSO-TR-77-166 ..... N78-18369 #
SAMSO-TR-77-213 ..... N78-19025*#

SAMTEC-TR-77-222 ..... N78-18033 #

SAND-77-8256 ..... N78-18164 #
SAND-77-8502 ..... N78-18079 #
SAND-77-8621 ..... N78-18403 #

SCIENTIFIC-1 ..... N78-18613 #
SCIENTIFIC-2 ..... N78-18328 #

SCRC-CR-77-45 ..... N78-18957 #

SC507-35AR ..... N78-19021*#
SC5023.10TR ..... N78-18430 #
SC5079.5FR ..... N78-18008 #

SD-77-MSFC-2149 ..... N78-18262*#

SDC-TM-5772/002/02 ..... N78-18807 #

SD77-MSFC-2150 ..... N78-18261*#
SD77-MSFC-2151 ..... N78-18626*#
SD77-MSFC-2152 ..... N78-18098*#
SD77-MSFC-2177 ..... N78-18625*#
SD77-MSFC-2178 ..... N78-18627*#
SD77-MSFC-2179 ..... N78-18628*#

SGD-397-PT-1 ..... N78-19023 #
SGD-397-PT-2 ..... N78-19024 #

SMRP-RP-145 ..... N78-18024*#

SRI-JSR-77-12 ..... N78-18412 #

SRI-MP-77-114 ..... N78-18611 #

SSS-R-78-3401 ..... N78-18285 #
SSS-R-78-3512 ..... N78-18227 #

STAN-CS-77-632 ..... N78-18778 #

STEWS-ID-77-1 ..... N78-18270 #

SU-DSL-TN-115 ..... N78-18318 #
SU-DSL-TN-116 ..... N78-18314 #

SU-DSL-TN-117 ..... N78-18799 #

SU-SEL-77-031 ..... N78-18275*#

SU-STAN-CS-77-627 ..... N78-18872 #

TANU-REP-77-2-D ..... N78-18668 #

THT-TN-77-009 ..... N78-18707 #
THT-TN-77-020 ..... N78-18915 #

TI-01-726210-F ..... N78-18337 #

TI-03-77-30 ..... N78-18886 #
TI-08-77-16 ..... N78-18338 #

TN-21 ..... N78-18621
TN-1977-17 ..... N78-18466 #
TN-1977-32 ..... N78-18099 #
TN-1977-39 ..... N78-18911 #

TNBAAS-81A(2/3) ..... N78-18169 #

TP-7AC024 ..... N78-18705 #

TR-4 ..... N78-18186 #
TR-6 ..... N78-18197 #
TR-9 ..... N78-18218 #
TR-13 ..... N78-18219 #
TR-21 ..... N78-18462 #
TR-25 ..... N78-18671 #
TR-77-2 ..... N78-18826 #
TR-77-7-25-VOL-1-REV ..... N78-18966 #
TR-77-7-25-VOL-2-REV ..... N78-18967 #
TR-77-7-25-VOL-3-REV ..... N78-18968 #
TR-77-9 ..... N78-18960 #
TR-250 ..... N78-18972 #
TR-251 ..... N78-18803 #
TR-252 ..... N78-18847 #
TR-252 ..... N78-18853 #
TR-255 ..... N78-18851 #
TR-262 ..... N78-18859 #
TR-266 ..... N78-18849 #
TR-268 ..... N78-18848 #
TR-269 ..... N78-18801 #
TR-270 ..... N78-18842 #
TR-591 ..... N78-18841 #
TR-0078(3550-15)-1 ..... N78-18161 #
TR-0078(3781-02)-1 ..... N78-18369 #
TR-0078(3960-05)-1 ..... N78-19025*#

TRB/TRR-625 ..... N78-19004 #

TRITA-EPP-77-17 ..... N78-19017 #

TRITA-NA-7708 ..... N78-18855 #

TSC-50463-1-VOL-1 ..... N78-18034 #
TSC-50463-1-VOL-2-APP ..... N78-18039 #

UAG-62 ..... N78-18615 #
UAG-63 ..... N78-18614 #

UCLA-ENG-7737 ..... N78-18367 #

UCRL-13732 ..... N78-18220 #
UCRL-13752 ..... N78-18423 #
UCRL-78782 ..... N78-18200 #

UILU-ENG-77-1753 ..... N78-18774 #

UIUCDCS-R-77-878 ..... N78-18774 #

UMTA-MA-06-0041-77-10-VOL-1 ..... N78-18034 #
UMTA-MA-06-0041-77-11-VOL-2 ..... N78-18039 #

UMTA-WA-11-0005-77-1 ..... N78-19005 #

US-PATENT-APPL-SN-529884 ..... N78-18761*
US-PATENT-APPL-SN-583055 ..... N78-18067*
US-PATENT-APPL-SN-623536 ..... N78-18083*
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US-PATENT-APPL-SN-665734 ..... N78-18390*
US-PATENT-APPL-SN-680958 ..... N78-18905*
US-PATENT-APPL-SN-684171 ..... N78-18183*

US-PATENT-APPL-SN-686449 ..... N78-18355*
US-PATENT-APPL-SN-708796 ..... N78-18410*
US-PATENT-APPL-SN-737974 ..... N78-18308*
US-PATENT-APPL-SN-858596 ..... N78-18395*#
US-PATENT-APPL-SN-858767 ..... N78-18266*#
US-PATENT-APPL-SN-873993 ..... N78-18253*#
US-PATENT-APPL-SN-876298 ..... N78-18762*#
US-PATENT-APPL-SN-876299 ..... N78-18394*#
US-PATENT-APPL-SN-876440 ..... N78-18674*#
US-PATENT-APPL-SN-876441 ..... N78-18396*#
US-PATENT-APPL-SN-878539 ..... N78-18393*#
US-PATENT-APPL-SN-878540 ..... N78-18045*#
US-PATENT-APPL-SN-878542 ..... N78-18313*#
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US-PATENT-CLASS-2-2.1 ..... N78-18761*
US-PATENT-CLASS-35-12N N78-18083*
US-PATENT-CLASS-60-39.31 ..... N78-18066*
US-PATENT-CLASS-60-204 ..... N78-18067*
US-PATENT-CLASS-60-226R N78-18066*
US-PATENT-CLASS-60-262 ..... N78-18067*
US-PATENT-CLASS-73-DIG.11 ..... N78-18390*
US-PATENT-CLASS-73-28 ..... N78-18390*
US-PATENT-CLASS-73-432PS N78-18390*
US-PATENT-CLASS-73-432R N78-18390*
US-PATENT-CLASS-75-124 ..... N78-18182*
US-PATENT-CLASS-75-126D N78-18182*
US-PATENT-CLASS-75-126F N78-18182*
US-PATENT-CLASS-75-126G N78-18182*
US-PATENT-CLASS-75-126T N78-18182*
US-PATENT-CLASS-75-170 ..... N78-18183*
US-PATENT-CLASS-148-32 ..... N78-18183*
US-PATENT-CLASS-148-32.5 ..... N78-18183*
US-PATENT-CLASS-244-53A N78-18066*
US-PATENT-CLASS-244-54 ..... N78-18066*
US-PATENT-CLASS-250-213VT N78-18905*
US-PATENT-CLASS-307-265 ..... N78-18308*
US-PATENT-CLASS-307-350 ..... N78-18308*
US-PATENT-CLASS-307-360 ..... N78-18308*
US-PATENT-CLASS-313-94 ..... N78-18905*
US-PATENT-CLASS-313-442 ..... N78-18905*
US-PATENT-CLASS-328-150 ..... N78-18308*
US-PATENT-CLASS-330-4 ..... N78-18410*
US-PATENT-CLASS-332-7.5 ..... N78-18410*
US-PATENT-CLASS-356-106S N78-18391*
US-PATENT-CLASS-356-110 ..... N78-18391*
US-PATENT-CLASS-358-104 ..... N78-18083*
US-PATENT-CLASS-427-34 ..... N78-18355*
US-PATENT-CLASS-427-405 ..... N78-18355*
US-PATENT-CLASS-427-419A N78-18355*
US-PATENT-CLASS-427-423 ..... N78-18355*
US-PATENT-CLASS-428-633 ..... N78-18355*
US-PATENT-CLASS-428-652 ..... N78-18355*
US-PATENT-CLASS-428-667 ..... N78-18355*

US-PATENT-3,514,785 ..... N78-18761*
US-PATENT-4,053,231 ..... N78-18391*
US-PATENT-4,055,004 ..... N78-18083*
US-PATENT-4,055,041 ..... N78-18066*
US-PATENT-4,055,089 ..... N78-18390*
US-PATENT-4,055,416 ..... N78-18182*
US-PATENT-4,055,447 ..... N78-18183*
US-PATENT-4,055,705 ..... N78-18355*
US-PATENT-4,055,777 ..... N78-18308*
US-PATENT-4,055,810 ..... N78-18410*
US-PATENT-4,069,661 ..... N78-18067*
US-PATENT-4,070,574 ..... N78-18905*

USAAEFA-76-13 ..... N78-18053 #

USAAMRDL-TR-77-21 ..... N78-18054 #

USAMBRDL-TR-7713 ..... N78-18575 #

USATTC-7705001 ..... N78-18764 #

USCG-D-11-77-VOL-1 ..... N78-18558*#

USCG-M-1-78 ..... N78-18023 #

USGS/WRD/WRI-77/075 ..... N78-18504 #

UTIAS-215 ..... N78-18077 #
UTIAS-218 ..... N78-18556 #

VPI-E-78-3 ..... N78-18132*#

WES-TR-Y-77-5 ..... N78-18574 #

WHO-240 ..... N78-18649 #
WHO-364 ..... N78-18650 #
WHO-469 ..... N78-18651 #
WHO-471 ..... N78-18645 #
WHO-476 ..... N78-18652 #
WHO-489 ..... N78-18644 #

WP-3-77-78 ..... N78-18970 #

WRC-77-3 ..... N78-19003 #

WYLE-TR-510-10-REV-A ..... N78-18521*#
WYLE-TR-531-05-REV-A ..... N78-18525*#

W78-01002 ..... N78-19003 #
W78-01004 ..... N78-19002 #

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